OPERATING AND SERVICE MANUAL

OPERATING AND SERVICE MANUAL

UNIVERSAL
INPUT PLUG-IN

MODEL 5285A

All Serials

05285-9007

GENERAL CALIBRATION
135 Route 10 East, Whippany, NJ 07981
(201) 428-2880
Fax (201) 428-3285

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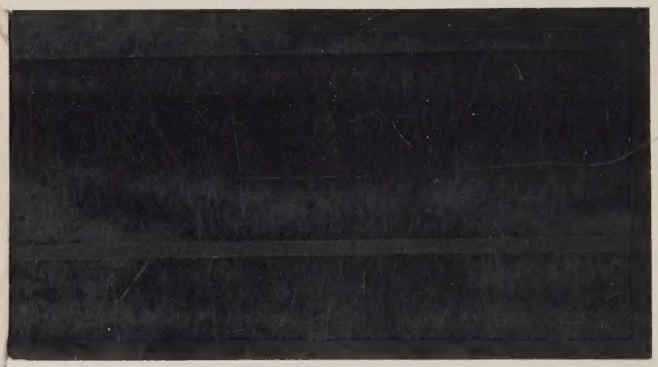

CERTIFICATION

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UNIVERSAL INPUT PLUG-IN
5285A

SERIALS PREFIXED: 602 AND 612

This manual applies directly to HP Model 5285A Universal Plug-in having serial prefix numbers 602 and 612.

SPECIAL INSTRUMENTS AND SERIAL PREFIXES NOT LISTED

The information required to relate this manual to special modifications, or to newer instruments with serial prefixes not listed, is supplied on special insert sheets. If this information is missing, contact any HP sales and service office, giving full specification number, instrument name, and serial number.

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5285A
universal input

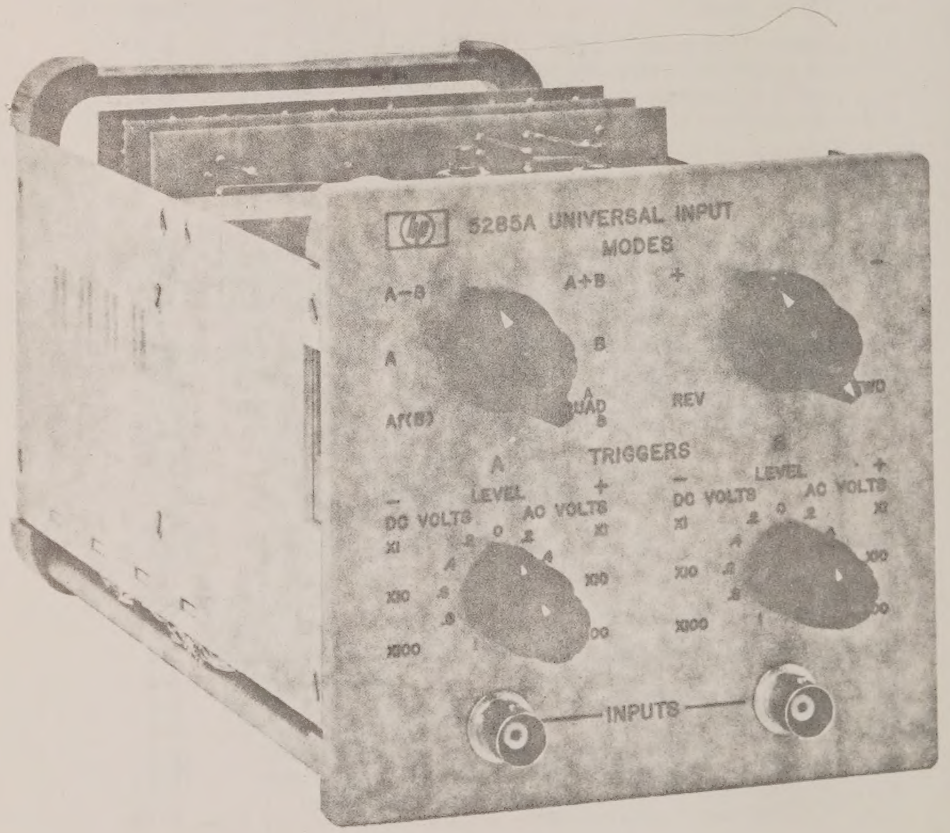


Figure 1-1. Model 5285A

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. DESCRIPTION.

1-3. The Hewlett-Packard Model 5285A Universal Plug-In provides separate input level controls and mode controls for the Hewlett-Packard 5280A Reversible Counter. Three basic modes of operation are possible. They are described in Paragraphs 1-4 through 1-10.

1-4. ALGEBRAIC A, B.

1-5. A: The A input is totalized, dc to more than 2 MHz, for the length of time the main gate is open. A-B: the input A minus the input B is totalized, dc to 1 MHz each channel, for the gate open period. In this mode, the 1 MHz rate is retained while reversing direction of count and while passing through zero. A+B: The input A plus the input B is totalized, dc to 1 MHz, for the gate open period. B: The B input is totalized, dc to more than 2 MHz, for the length of time the main gate is open.

1-6. A directional MODE switch can be used to invert the measurements in the above 4 modes; i.e., -A, -A + B, -A - B, and -B. An anti-coincident circuit prevents the loss of any counts (A + B and A - B modes) that arrive at the inputs in time coincidence. Two asynchronous inputs such as those shown in Figure 1-2 can be used, and may provide simultaneous add and/or subtract signals, without causing a measurement error.

1-7. A QUAD B.

1-8. This mode of operation is designed to operate with transducers having two outputs separated 90° in phase (in quadrature). The A input is totalized, up or down according to its phase relationship with the B input. When A lags B, A is totalized in a positive direction. When A leads B, A is totalized in a negative direction. The direction of count may be reversed at a 1 MHz rate. In this mode the A and B input range is dc to 1 MHz. An example of this measurement application is shown in Figure 1-3.

1-9. Af(B).

1-10. In this mode of operation, A is counted forward when the B input is more positive than its trigger level setting and A is counted in reverse when B is more negative than its trigger level. In this mode the A input range is dc to 2 MHz. An example of this mode of operation is shown in Figure 1-4.

1-11. A "FWD" "REV" position is available on the directional MODE switch to invert the input B count direction information in the Af(B) and A QUAD B modes.

1-12. SPECIFICATIONS.

1-13. Table 1-1 contains all technical specifications for the Model 5285A when operated in the Model 5280A Reversible Counter. Values and measurements provided in other sections of the manual to assist the operator or technician do not constitute additional specifications.

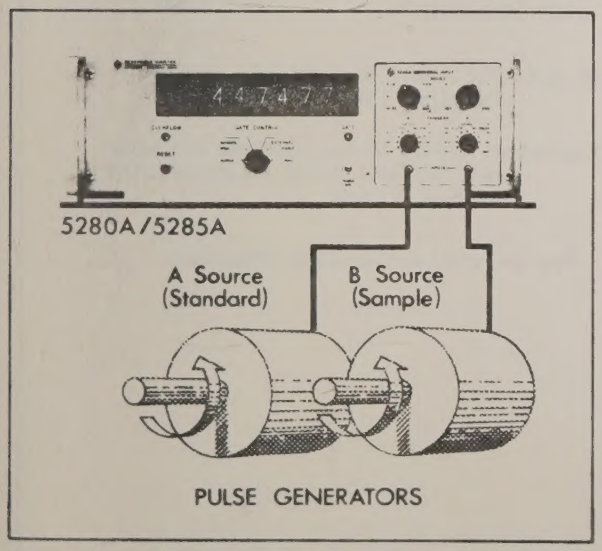


Figure 1-2. Example of A - B Operation

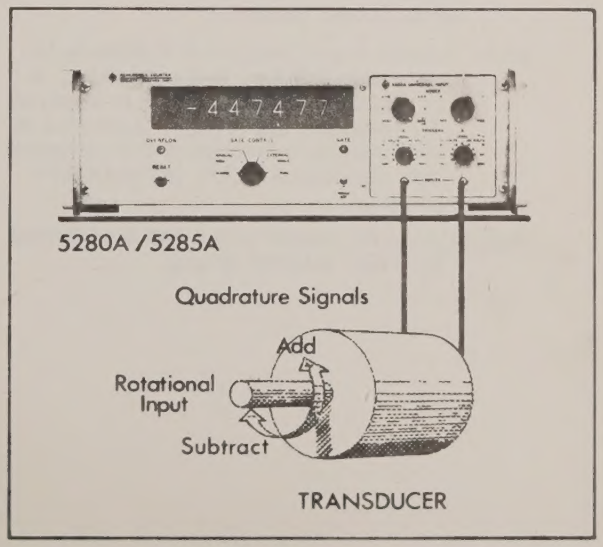


Figure 1-3. A QUAD B Mode of Operation

Table 1-1. Specifications

INPUT CHANNELS (A AND B):

Range: Dc coupled: 0 to more than 2 MHz.
Ac coupled: 10 Hz to more than 2 MHz.

Impedance: Approximately 1 megohm, 75 pf shunt.

Maximum Input: Ac coupled: ±600 volts peak; Dc coupled: 25 volts rms (X1), 150 volts rms (X10), 350 volts rms (X100).

Sensitivity: 0.1 volts rms sine wave; 1 volt pulse, 0.2 μsec minimum width.

Trigger Level: -100 to +100 volts, adjustable, independent controls on each channel.

MONITOR OUTPUT (Channels A and B)

7 volts peak-to-peak; from 800 ohms, 20 pf shunt source impedance, nominal value.

MODES OF OPERATION:

A Quad B: Two inputs separated 90° in phase. Max rate each channel -1 MHz.

Totalizes A positively if A lags B.
Totalizes A negatively if A leads B.
(Above for directional MODE switch in FWD position. Count direction reversed with switch in REV position).

Af(B): Counts A as a function of B from dc to more than 2 MHz. If B is positive, A is totalized positively. If B is negative, A is totalized negatively. (Direction of A counted as a function of B is reversed with directional MODE switch in REV position.)

Algebraic A, B: Counts both A and B according to MODE selector setting.

MODES OF OPERATION (cont'd)

A: A only to greater than 2 MHz.

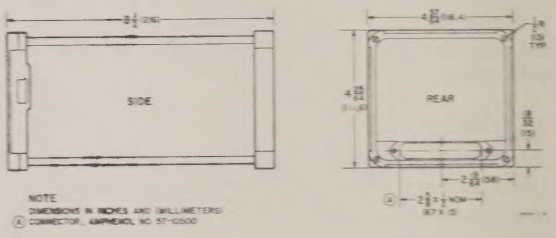
A-B: Input A minus Input B to 1 MHz for both A and B. Anti-coincident circuit prevents count loss when pulses arrive in time coincidence.

A+B: Input A plus Input B 1 MHz for both A and B. Anti-coincident circuit prevents count loss when pulses arrive in time coincidence.

B: B only to greater than 2 MHz. (Direction of counting is reversed with the directional MODE switch in - position, i.e., modes would be -A, -A+B, -A - B, -B.)

PHYSICAL SPECIFICATIONS:

Dimensions:



Weight: Net 3 lbs 2 oz (1, 94 kg), Shipping 7 lbs 2 oz (3, 75 kg)

Engraving: MODE switch positions are color keyed to relate MODE functions to the direction of count.

* For operation in HP Model 5280A only.

1-14. INSTRUMENT IDENTIFICATION.

1-15. Hewlett-Packard uses a two-section, eight-digit serial number to identify instruments. The serial number is located on a serial plate on the rear frame of the Model 5285A. The first three digits are a serial prefix number which identifies the instrument with respect to changes made during manufacture. The last five digits refer to a specific instrument. If the first three digits of your instrument serial number do not appear on the title page of this manual, there are differences between the manual and your instrument. These differences are described in Section VII or in a change sheet included with the manual. If the change sheet is missing, the information can be supplied by your nearest Hewlett-Packard field office.

1-16. ACCESSORIES AVAILABLE.

1-17. A fifty-conductor cable (HP Part No. 10506B) is available from Hewlett-Packard. This cable provides interconnections between the counter jack and the plug-in mating plug when the unit is outside the plug-in compartment.

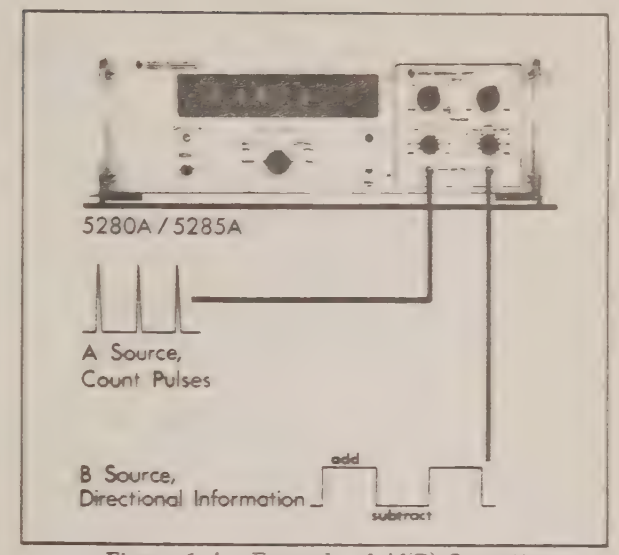


Figure 1-4. Example of Af(B) Operation

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information on unpacking, inspection, repacking, storage and installation.

2-3. UNPACKING AND INSPECTION.

2-4. If the shipping carton is damaged, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage (scratches, dents, broken knobs, etc). If the instrument is damaged or fails to meet specifications (Performance Check, Table 5-3), notify the carrier and the nearest Hewlett-Packard field office immediately (field offices are listed at the back of this manual). Retain the shipping carton and the padding material for the carrier's inspection. The field office will arrange for the repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-5. STORAGE AND SHIPMENT.

2-6. PACKAGING. To protect valuable electronic equipment during storage or shipment always use the best packaging methods available. Your Hewlett-Packard field office can provide packing material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice. Here are two recommended packaging methods:

a. RUBBERIZED HAIR. Cover painted surfaces of instrument with protective wrapping paper. Pack instrument securely in strong corrugated container (350 lb/sq in. bursting test) with 2-inch rubberized hair pads placed along all surfaces of the instrument. Insert fillers between pads and container to ensure a snug fit.

b. EXCELSIOR. Cover painted surfaces of instrument with protective wrapping paper. Pack instrument in strong corrugated container (350 lb/sq in. bursting test) with a layer of excelsior about 6 inches thick packed firmly against all surfaces of the instrument. Mark the box "Delicate Instrument" and seal with strong tape or metal bands.

2-7. ENVIRONMENT. Conditions during storage and shipment should normally be limited as follows:

a. Maximum altitude 20,000 feet.

b. Minimum temperature -40°F (-40°C).

c. Maximum temperature 167°F (75°C).

CAUTION

TURN COUNTER POWER OFF BEFORE INSTALLING OR REMOVING UNIVERSAL INPUT PLUG-IN UNIT.

2-8. INSTALLATION.

2-9. The Model 5285A plugs into the rectangular compartment at the right hand side of the front panel of the Model 5280A Electronic Counter. To install unit in counter, turn counter off and turn the retaining latch knob counterclockwise. Insert Prescaler Unit into counter and push unit firmly into compartment until front panel or plug-in is flush with the front panel of the counter. Turn the retaining latch knob clockwise until it is tight.

2-10. To remove unit from counter, turn counter off and turn the retaining latch knob counterclockwise to its stop. Then grasp switch knob and pull unit from counter. If any difficulty is encountered with installation or removal, check that the retaining latch is fully counterclockwise.

2-11. COOLING.

2-12. The Model 5285A is cooled by the ventilating system of the counter in which it is installed. See operating and service manual of counter for cooling system maintenance instructions.

2-13. POWER REQUIREMENTS.

2-14. All electrical power required to operate the Model 5285A is supplied by the counter in which the unit is installed.

2-15. ELECTRICAL CONNECTIONS.

2-16. The INPUT connectors on the front panel of the plug-in (see Figure 3-1) are the only external electrical connections to the plug-in. All other connections are made through the 50-pin connector (P1) at the rear of the plug-in when the unit is installed in the counter.

SECTION III
OPERATION

3-1. CONTROLS AND INPUTS.

3-2. The function of the front panel MODE switches, LEVEL controls, and inputs are shown in Figure 3-1. Additional inputs are available on the rear of the counter (J2 and J3). These are wired in parallel with the plug-in front panel connectors through the 50-pin connector in the plug-in compartment.

3-3. OPERATING PROCEDURES.

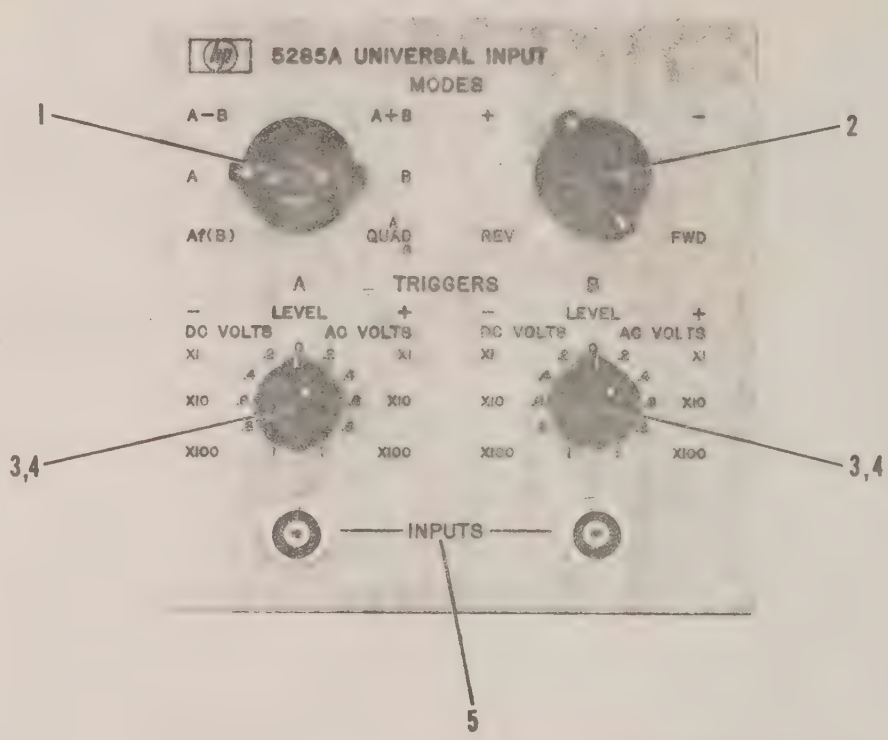
3-4. Figures 3-1 through 3-7 provide step-by-step procedures for operating the Model 5285A Plug-In.

3-5. MONITOR OUTPUT.

3-6. The MONITOR outputs from A7(5) and A7(18) are available on the rear of the counter, J4 and J5. The outputs display the output waveforms of the Schmitt Triggers. The waveforms are used to adjust for proper operation of A QUAD B MODE. The waveforms may also be used as marker signals for other modes of operation.

Table 3-1. Maximum Input Levels

Dc Coupled		Ac Coupled		
X1	25V rms	X1	25V rms	Dc component + Ac signal should not exceed ± 600V p.
X10	150V rms	X10	150V rms	
X100	350V rms	X100	350V rms	



1. MODE SWITCH - Function selector.

   A MODE: A input is totalized.
   A-B MODE: A input - B input is totalized.
   A + B MODE: A input + B input is totalized.
   B MODE: B input is totalized.
   A QUAD B: A input totalized according to Phase of B input.
   Af(B): A input totalized according to the polarity of B input.

2. MODE SWITCH - polarity or direction indication selector. Color coded to modes of operation.

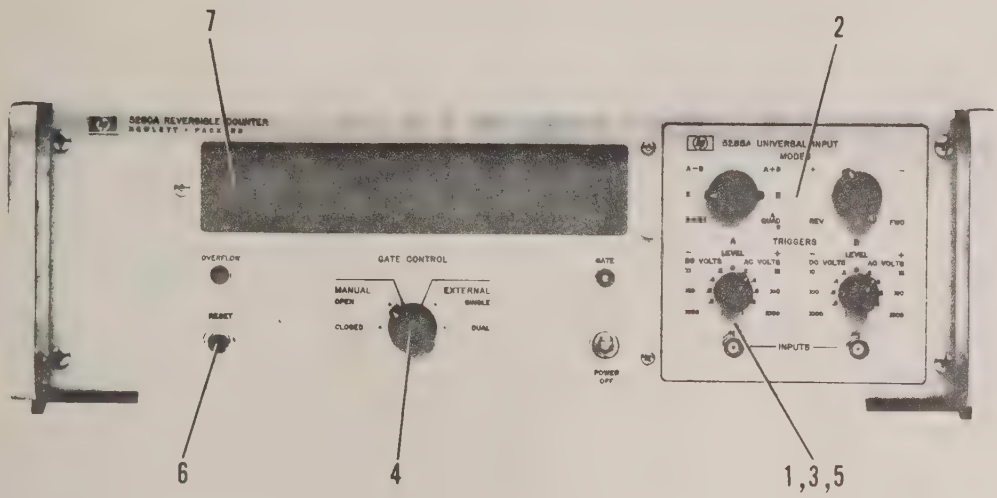
3. DC VOLTS/AC VOLTS. These selectors are used to select dc or ac coupling of input signals and attenuation of input signals by factors of 1, 10, or 100. Set to minimum sensitivity (X100) before connecting input signal. For instrument protection never exceed maximum listed in Table 3-1.

4. LEVEL A - LEVEL B. These controls are used to adjust the triggering levels on the input signals from -1 volt to +1 volt times the multiplier setting.

5. INPUTS. Channel A and Channel B signal inputs.

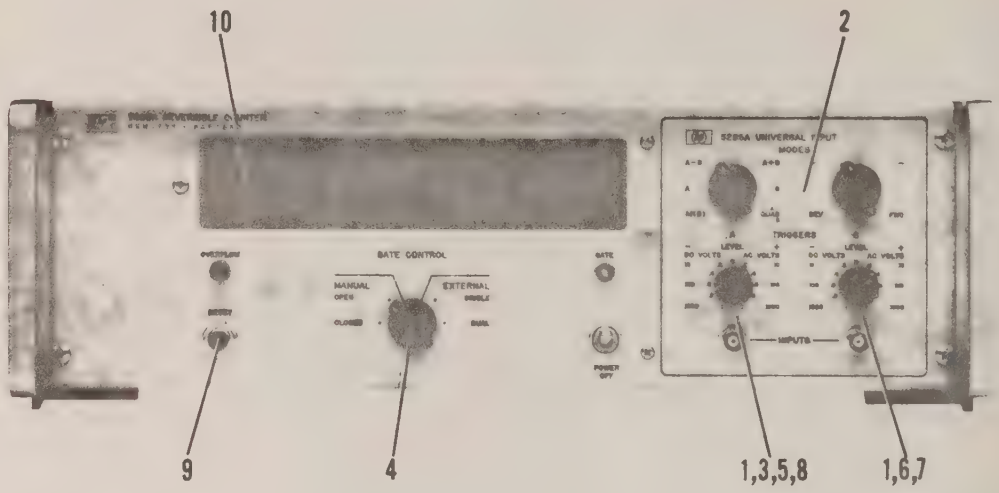
Figure 3-2. A Mode

A MODE



1. Set DC VOLTS/AC VOLTS selector (Channel A) to DC VOLTS X 100.
2. Set MODE selectors to A and desired polarity (+ or -).
3. Connect signal to Channel A INPUT connector.
4. Set Counter GATE CONTROL selector to desired gate mode.
5. Adjust DC VOLTS/AC VOLTS selector and Channel A LEVEL control until counter displays a consistent count.
6. Reset Counter.
7. Display will be A totalized.

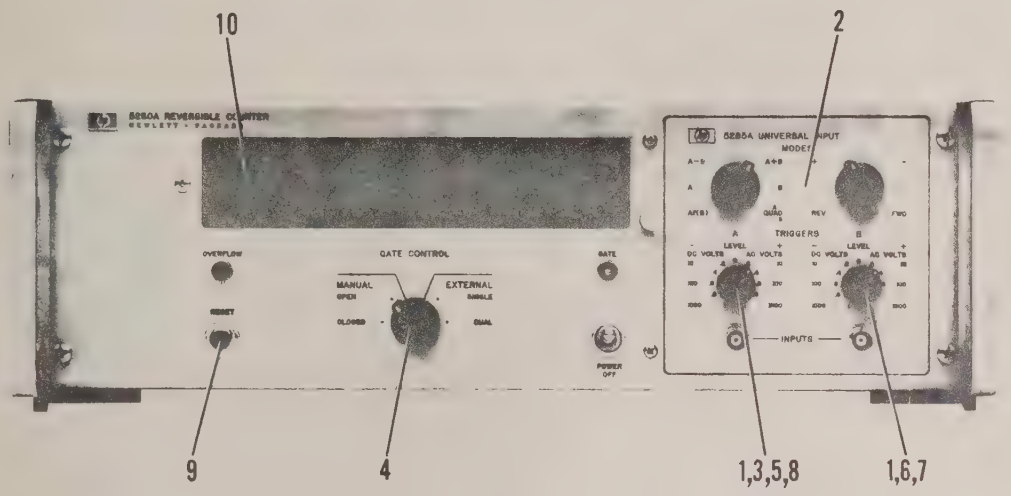
A - B MODE



1. Set DC VOLTS/AC VOLTS selectors (Channels A and B) to DC VOLTS X100.
2. Set MODE selectors to A-B and desired polarity (+ or -).
3. Connect signal to Channel A INPUT connector.
4. Set Counter GATE CONTROL to desired mode.
5. Adjust DC VOLTS/AC VOLTS selector and A LEVEL control until Counter displays a consistent count.
6. Remove Channel A signal and connect Channel B signal to B INPUT connector.
7. Adjust DC VOLTS/AC VOLTS selector and B LEVEL control until Counter displays a consistent count.
8. Reconnect Channel A input signal.
9. Reset Counter.
10. Display will be A - B totalized.

Figure 3-3. A - B Mode

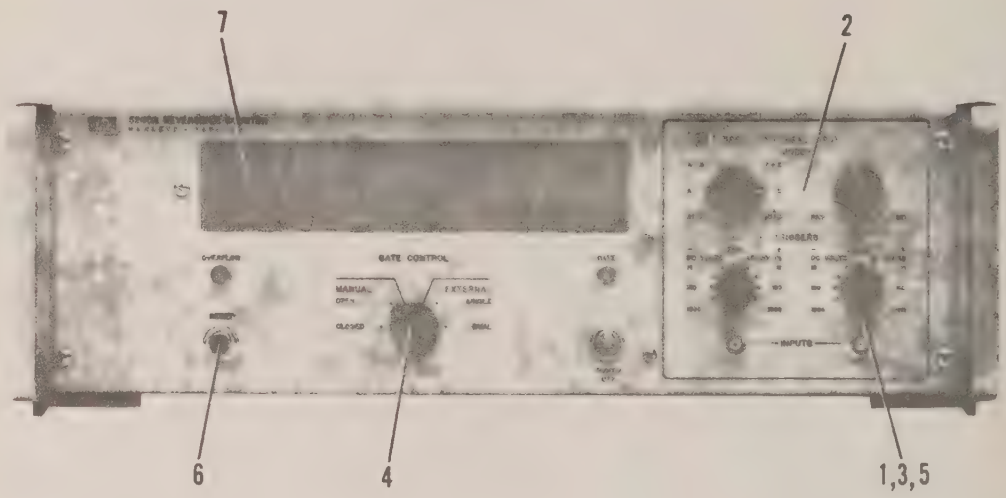
A + B MODE



1. Set DC VOLTS/AC VOLTS (Channels A and B) to DC VOLTS X100.
2. Set MODE selectors to A + B and desired polarity (+ or -).
3. Connect signal to Channel A INPUT connector.
4. Set Counter GATE CONTROL selector to desired mode.
5. Adjust DC VOLTS/AC VOLTS selector and A LEVEL control until Counter displays a consistent count.
6. Remove Channel A signal and connect Channel B signal to B INPUT connector.
7. Adjust DC VOLTS/AC VOLTS selector and B LEVEL control until Counter displays a consistent count.
8. Reconnect Channel A input signal.
9. Reset Counter.
10. Display will be A + B totalized.

Figure 3-4. A+B Mode

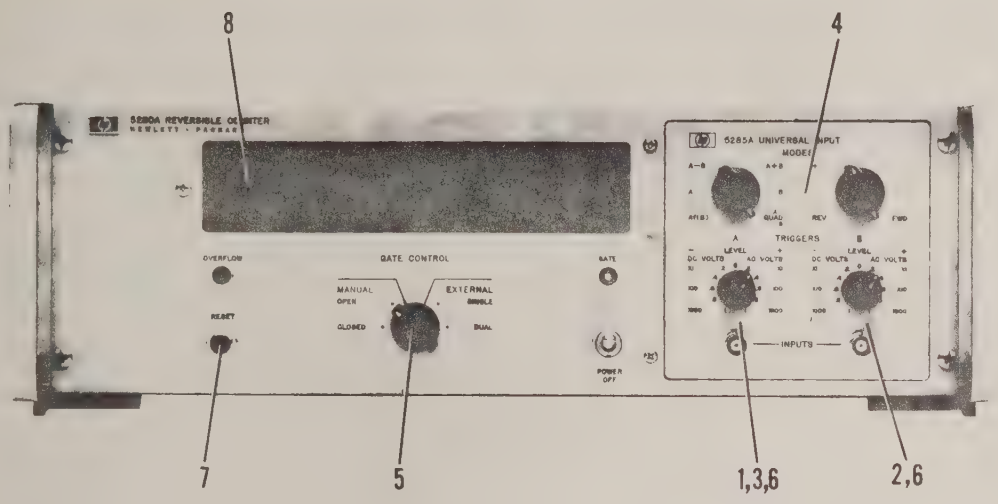
B MODE



1. Set DC VOLTS/AC VOLTS selector (Channel B) to DC VOLTS X100.
2. Set MODE selectors to B and desired polarity (+ or -).
3. Connect signal to Channel B INPUT connector.
4. Set Counter GATE CONTROL to desired mode.
5. Adjust DC VOLTS/AC VOLTS selector and Channel B LEVEL control until counter displays a consistent count.
6. Reset Counter.
7. Display will be B totalized.

Figure 3-5. B Mode

A QUAD B MODE



1. Connect Channel A input signal and adjust as shown in Steps 1 through 5 in Figure 3-2.

2. Disconnect Channel A input signal and connect Channel B input signal. Adjust as shown in Steps 1 through 5 in Figure 3-5.

3. Reconnect Channel A input signal.

4. Set MODE selectors to A QUAD B and desired direction (FWD or REV).

5. Set Counter GATE CONTROL selector to desired mode.

6. Make the final adjustment of A and B LEVEL controls.

   Note

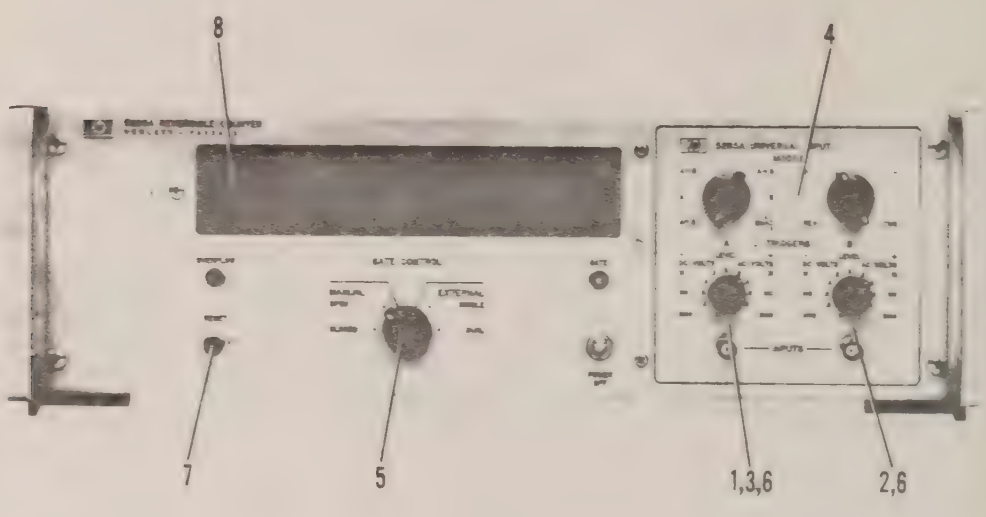
   Trigger outputs should be monitored at the rear of the Counter at MONITOR jacks J4 and J5. The outputs should approximate square waves that are adjusted for 50% duty cycle at the maximum frequency to be used. There should be a 90° phase difference between A and B signals.

7. Reset Counter.

8. Display meaning will depend on type of measurement being made.

Figure 3-6. A QUAD B Mode

Af(B) MODE



1. Connect Channel A input signal and adjust as shown in Steps 1 through 5 in Figure 3-2.
2. Disconnect Channel A input signal and connect Channel B input signal. Adjust as shown in Steps 1 through 5 in Figure 3-5.
3. Reconnect Channel A input signal.
4. Set MODE selectors to Af(B) and desired direction (FWD or REV).
5. Set Counter GATE CONTROL to desired mode.
6. Make final adjustment of Channels A and B LEVEL controls.
7. Reset Counter.
8. Display will be A totalized.

Figure 3-7. Af(B) Mode

SECTION IV
PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section describes how the Model 5285A operates. Basic circuits used in the plug-in are described in Paragraphs 4-3 through 4-9. Each assembly is then described in order of its assembly designation (A__) in Paragraphs 4-13 through 4-39.

4-3. FLIP-FLOP. The flip-flop is a bi-stable two-transistor circuit in which one transistor conducts, holding the other cut off. Each input pulse causes a reversal of states; that is, the cut off transistor is turned on and the conducting transistor is cut off. In the flip-flop shown in Figure 4-1A, Q1 is initially conducting heavily; its collector voltage is only slightly negative; a near-zero voltage is supplied to the base of Q2 (junction of R27-28 divider). The voltage drop across R24 produces a sufficiently negative voltage at the emitter of Q2 to hold Q2 cut off. With Q2 cut off, the R18-R19-R20 divider delivers a negative voltage to the base of Q1 to keep it conducting.

4-4. At time t_1 the positive input pulse cuts off Q1; the Q1 collector voltage goes negative and drives Q2 into conduction (R27-R28 divider to Q2 base); the Q2 collector voltage and the Q1 base voltage (R19-R20 divider) then become considerably less negative, permitting Q1 to remain cut off. The R26-R27-R28 divider delivers a sufficiently negative voltage to the base of Q2 to drive it into conduction. In a similar manner the positive input pulse at time t_2 cuts off Q2 and starts a sequence of events which ends with Q1 conducting and Q2 cut off. Note that a positive input pulse has no effect on Q1 if it is already cut off. A negative reset pulse applied to the base of Q1 returns the flip-flop to its initial condition (Q1 conducting, Q2 cut off). The diode CR9 removes the negative pulse from the differentiated square wave input. Without this diode, the negative pulse would drive Q1 which is cut off and the stage would switch from one state to the other but would not divide by two. The coupling through C2 and C3 insures fast switching. The dc coupling through R19 and R27 insures bi-stable characteristics.

4-5. TRIGGER CIRCUIT. The trigger circuit is a limiter or squaring circuit which produces an output waveform with very fast rise and fall times. The trigger circuit is similar to the flip-flop except that the RC network in one half is replaced by the input signal. Capacitor C1 bypasses R3 to couple fast changes in voltage at the Q1 collector to the base of Q2. Either Q1 or Q2 can conduct depending on the voltage at the input. Note that there is a slight difference in input voltage (called hysteresis) between switching with a negative-going input (time t_1) and switching with a positive-going input (time t_2).

4-6. ONE-SHOT MULTIVIBRATOR. The one-shot multivibrator is a circuit which generates a pulse of

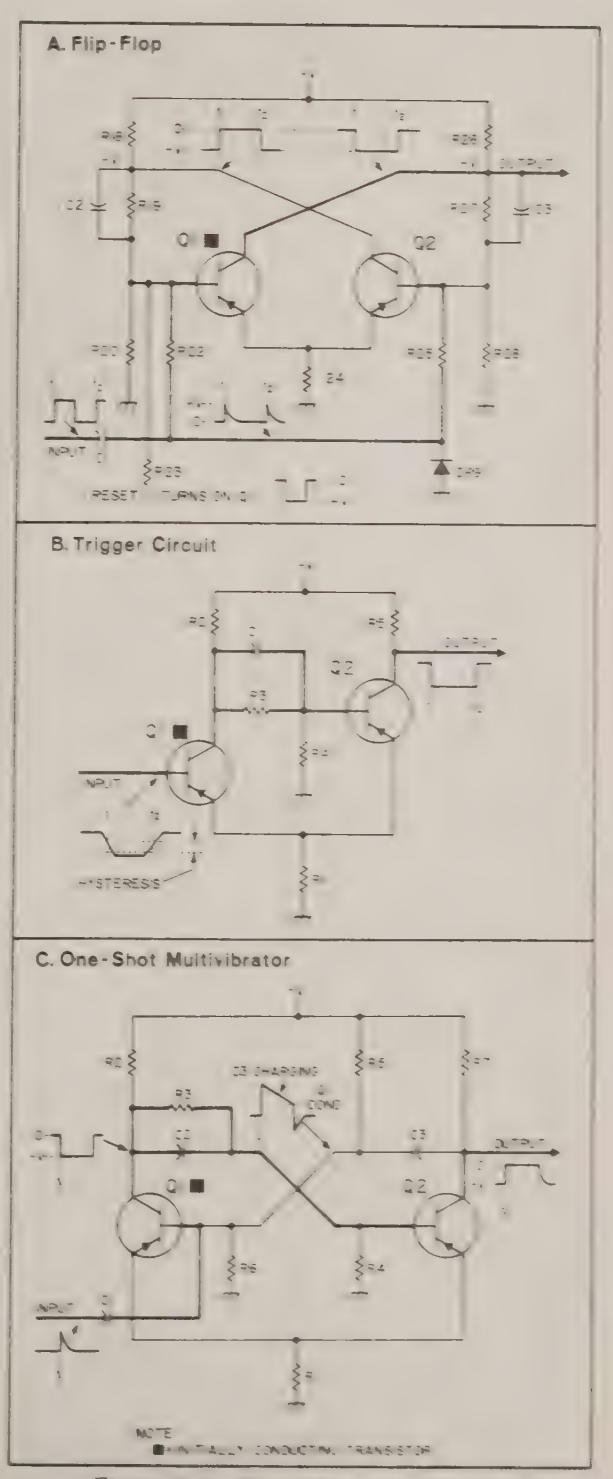


Figure 4-1. Basic Transistor Circuits

some specified duration following the application of a suitable triggering pulse. The circuit is similar to the flip-flop except one dc coupling path has been removed so the circuit is stable only in the state with Q1 conducting.

4-7. In the typical one-shot multivibrator shown in Figure 4-1C the following conditions exist during the initial stable period: the R5-R6 divider delivers a sufficiently negative potential to the base of Q1 to hold Q1 in saturation; the Q1 collector and Q1 emitter are therefore slightly negative; the R3-R4 divider delivers the Q2 base an even smaller negative voltage to hold Q2 cut off.

4-8. The positive triggering pulse at time t_1 reduces conduction of Q1; the resulting negative-going voltage at the Q1 collector is applied to the Q2 base through the R3-R4 divider (C2 bypasses R3 to provide coupling for the rapidly changing voltage at the Q1 collector). Q2 begins to conduct; the resulting positive-going change in Q2 collector voltage is coupled through C3 to the Q1 base to further decrease Q1 conduction. The process is regenerative and quickly results in Q1 being cut off and Q2 being saturated.

4-9. Capacitor C3 now charges at a rate mainly determined by the values of R6 and C3 (main charge path: R1-Q2-C3-R5). When the Q1 base voltage becomes sufficiently negative, Q1 begins conduction; the resulting positive-going Q1 collector voltage is coupled to the Q2 base; the Q2 collector voltage goes negative and is coupled through C3 to the Q1 base to further increase Q1 conduction. The process is regenerative and ends with the circuit in its original quiescent state, Q1 saturated and Q2 cut off.

4-10. SYMBOLOGY. In the following descriptions "A" and "$\bar{A}$" (read as "A bar" or "not A") are used. They are used to indicate a 180° phase difference in pulses.

4-11. "NAND" GATE. The "nand" gate is an extension of the conventional "and" gate. The term "nand" gate is a contraction of "not and", "and-not" being the logic function performed by the gate. The output is false only when both inputs are true, and true when either, or both, of the inputs are false. A "nand" gate is the result of using an active inverting element in the gate circuitry. The "nand" gate may have any number of inputs.

4-12. In the following descriptions, various counting modes are described as counting in a positive or a negative direction. A positive (+) count is an increase in magnitude in a positive direction with respect to zero. A negative (-) count is an increase in magnitude in a negative direction with respect to zero. If the count is in a positive (+) direction and the count reverses direction, the count will be a decrease in positive (+) magnitude until the zero crossing point is reached. The sign will then change from + to - and the count will increase in magnitude in a negative (-) direction.

4-13. OVERALL PLUG-IN OPERATION.

4-14. INPUT ATTENUATOR ASSEMBLY A1(A2).

4-15. The input attenuator assemblies (designated DC VOLTS/AC VOLTS on the front panel) are six-position attenuators (DCX1, DCX10, DCX100, ACX1, ACX10, ACX100), providing dc or ac coupling and attenuation to the signal input of the differential amplifier. The dummy attenuator section sets up the proper levels to the control input of the differential amplifier. Refer to the schematic diagram, Figure 8-4.

4-16. DIFFERENTIAL AMPLIFIER A3(A4).

4-17. The input dc differential amplifiers A3 (Channel A) and A4 (Channel B) provide trigger level control and stable voltage gain to the attenuated input signals. The attenuated input signal is impedance-matched to the signal side of the differential amplifier A3 (A4) Q2A, while the dummy attenuator sets up the proper levels for the reference side of the differential amplifier A3(A4) Q2B. The LEVEL control adjusts the dc operating level of the reference side of the differential amplifier A3(A4)Q2B. Diodes A3(A4) CR1 and CR2 are limiters. This first stage of the differential amplifier is driven by a constant current generator A3(A4)Q1. This allows the LEVEL control to be adjusted without affecting the gain of the differential amplifier. A3(A4) CR3 provides a voltage reference for the constant current generator. A3(A4) Q2A and A3(A4)Q3 form a feedback amplifier in the signal side of the differential amplifier, and A3(A4) Q2B and A3(A4)Q4 form a feedback amplifier in the control side of the differential amplifier. The negative feedback amplifiers provide stable gain over a wide bandwidth. The outputs of the differential amplifier are converted to current gain by the driver stages A3(A4) Q5 and Q6, and applied to the trigger amplifier circuit.

4-18. TRIGGER AMPLIFIER ASSEMBLY A5(A6)

4-19. The trigger amplifiers A5 (Channel A) and A6 (Channel B) are shaping circuits providing the constant amplitude signal necessary to drive the directional control assembly A7 and the priority assembly A8. The trigger circuit A5(A6) Q1 and Q2 is a flip-flop circuit; see Paragraph 4-3 for a description of operation. The signals from the driver stages of the differential amplifier A3(A4) Q5 and Q6 are dc coupled to the bases of the trigger flip-flop A5(A6) Q1 and Q2. These inputs jointly control the state of the trigger flip-flop. There are two possible outputs from the trigger flip-flop: 1) the positive slope output is taken from the collector of A5(A6) Q2 and applied to amplifier A5(A6)Q4; and 2) the negative slope output is taken from the collector of A6 Q1 and applied to amplifier A6Q3. A5 is connected for positive slope operation at all times. A6 slope is selected by MODE switch S2 in A QUAD B and Af(B) modes. With the trigger

LEVEL set for a positive level and positive slope operation, the output is taken off the side of the trigger flip-flop, A5(A6) Q2, which goes negative the instant the input signal crosses the trigger level on the positive slope. This negative transition turns on A5(A6) Q4 which produces a positive output pulse. With the same conditions, but with a negative slope, the output is taken off the side of the trigger flip-flop, A6Q1, which goes negative the instant the input signal crosses the trigger level on the negative slope. This negative transition turns on A6Q3 and produces a positive output pulse. The output pulse from the collector of A6Q3 or the collector of A5(A6)Q4 is used to drive the directional control assembly A7 and priority assembly A8. Refer to schematic diagram, Figure 8-5, for circuit details.

4-20. DIRECTIONAL CONTROL ASSEMBLY A7.

4-21. GENERAL. The directional control assembly A7 has three basic signal paths. The Channel A signal is amplified by A7Q1. The output of A7Q1 is shaped by A7C4, A7R17 and drives A7Q4. The output of A7Q4 goes to the counter as the Channel A signal or the $\overline{A}$ signal depending on the mode of operation. The Channel A input signal also drives the monitor amplifier A7Q9. The monitor output goes to a jack on the rear of the counter.

4-22. The Channel B signal goes through NAND gate A7Q6, A7Q7; is shaped by A7C5, A7R27; and drives pulse amplifier A7Q11. The output of A7Q11 goes to the counter as the Channel B signal or the A signal, depending on the mode of operation. The Channel B input signal drives the monitor amplifier A7Q10. The monitor output goes to a jack on the rear of the counter. The Channel B signal also drives the directional multivibrator A7Q2, A7Q8. The emitter followers A7Q3, A7Q5 in the collector circuit of A7Q2, A7Q8 provide faster switching. The outputs are used as gating signals, B and $\overline{B}$, in the A QUAD B and Af(B) modes.

4-23. A MODE. In the A mode of operation, the Channel A signal is amplified by A7Q1, shaped by A7C4, A7R17, and amplified by A7Q4. The output of A7Q4 goes to the counter.

4-24. B MODE. In the B mode of operation, the Channel B signal goes through NAND gate A7Q6, A7Q7; is shaped by A7C5, A7R27; and is amplified by A7Q11. The output of A7Q11 goes to the counter. In the B mode A7Q6 is biased with +13 volts and appears as a short to A7Q7 so the Channel B signal goes to A7Q11.

4-25. A QUAD B MODE. In the A QUAD B mode the Channel A signal produces an output from A7Q4 and A7Q11. The output of A7Q1 goes to A7Q4 and through A7R14 to A7Q6. The output of A7Q4 becomes $\overline{A}$ and the output of A7Q11 becomes A (see Figure 8-6). The Channel B signal drives the directional multivibrator A7Q2, A7Q8. The output from A7Q2 becomes B. The A and $\overline{A}$ signals are 180° out of phase. They are 90° out of phase with B ($A \cdot B$, see Figure 4-2A), A is totalized in a positive (increase) direction. When A leads B ($\overline{A} \cdot B$, see Figure 4-2B), A is totalized in a negative (decrease) direction.

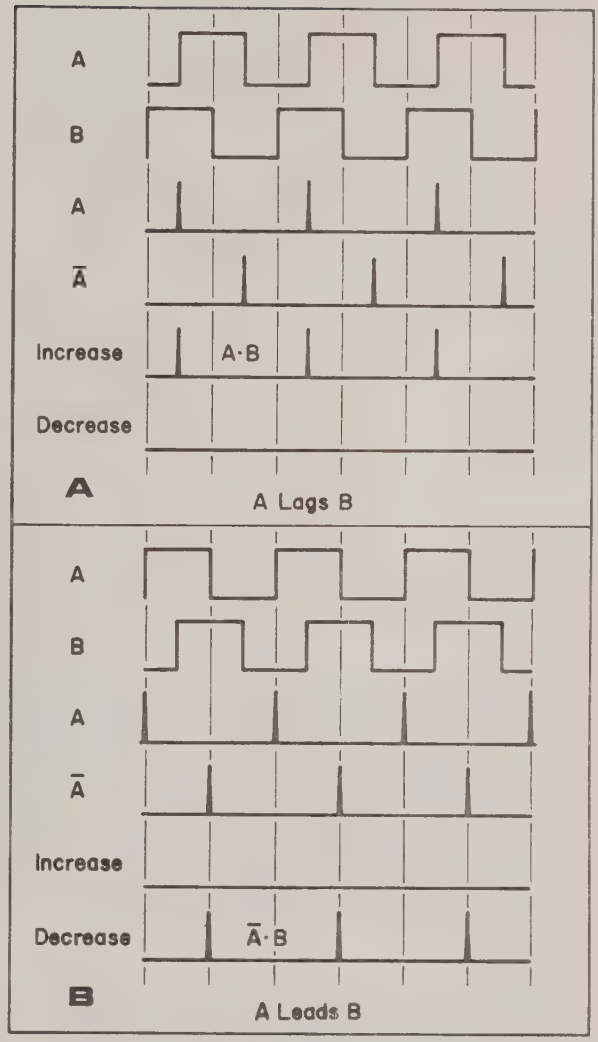


Figure 4-2. A QUAD B Counting Sequence

4-26. Af(B) MODE. In the Af(B) mode the B and $\overline{B}$ signals control the direction the A signal is counted. ($\overline{A}$ is not used.) The gates in the counter are controlled by a negative signal from the directional multivibrator. When the A and B signals occur together (see Figure 4-3) A total increases. When A and $\overline{B}$ signals occur together, A total decreases.

4-27. PRIORITY ASSEMBLY A8.

4-28. The priority assembly A8 consists of two identical one-shot multivibrators and the priority selector (see Figure 4-4.) The priority assembly A8 and the anti-coincidence assembly A9 are assemblies which must be checked together for proper alignment of anti-coincidence operation. They are used only in the A + B and A - B modes.

Note

If repairs, adjustments or replacements are made to either assembly, both must be checked as a set for proper operation (see Para. 5-16).

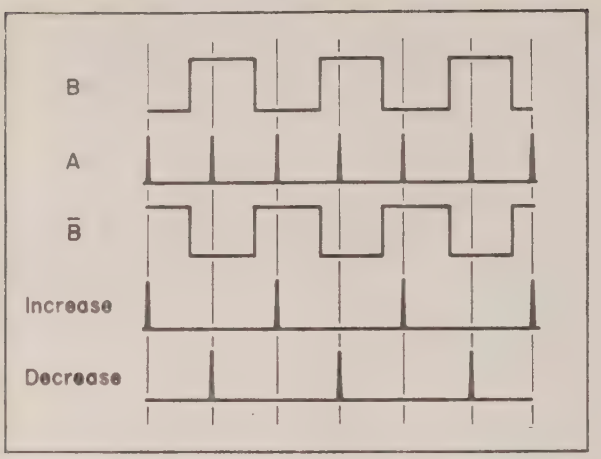


Figure 4-3. Af(B) Counting Sequence

4-29. Assume signals are applied to both A and B INPUT channels with the A signal leading the B signal (see Figure 4-4). The A signal triggers the one-shot multivibrator A8Q1, A8Q3. The output of A8Q3 goes to the anti-coincidence assembly A9 and the priority selector A8Q5, A8Q6. The priority selector is triggered by the leading edge of the pulse which turns off A8Q5. The output of emitter follower A8Q7 is the priority control signal A that goes to the anti-coincidence assembly A9 and insures that A8Q6 is held on. The B signal triggers the one-shot multivibrator A8Q2, A8Q4. The output from A8Q4 goes to the anti-coincidence assembly A9 and to the priority selector A8Q5, A8Q6; but A8Q6 is held on by the A signal applied through A8R26. A small amount of signal will get through A8C10 but will not be enough to trigger the flip-flop.

4-30. If the B signal leads the A signal, conditions are reversed. The output from A8Q4 triggers the priority selector A8Q5, A8Q6. The B signal through A8C10 turns off A8Q6. The output of A8Q8 is the priority control signal B that goes to the anti-coincidence assembly A9 and also holds A8Q5 on. This will set the priority flip-flop in the B priority state.

4-31. If both signals should arrive at exactly the same time, the priority selector will arbitrarily choose pulse priority.

4-32. ANTICOINCIDENCE ASSEMBLY A9.

4-33. The anticoincidence circuit provides a means of counting two coincident pulses without losing a count.

4-33. The following description explains the operation of the anticoincidence circuit when it receives two pulses that are in time coincidence. In this case the A input is leading the B input so that an A priority signal is received from the priority assembly A8. Refer to Paragraphs 4-3 and 4-6 for operation of multivibrators and flip-flops. See Figure 4-4 logic diagram and waveforms, and Figure 8-8 schematic diagram.

4-34. The Channel A input signal (see waveform 2A) drives the Channel A driver amplifier (A9Q1). The resulting negative transition triggers the one-shot (A9Q3, A9Q5, A9Q7) by turning on A9Q5 and A9Q7, providing one-shot output (see waveform 4A). The one-shot remains in its astable state until A9C5 is charged. It then returns to its stable state. The charging rate of A9C5 is determined by the control signal applied through A9CR7 (see waveform 8A) from the priority flip-flop.

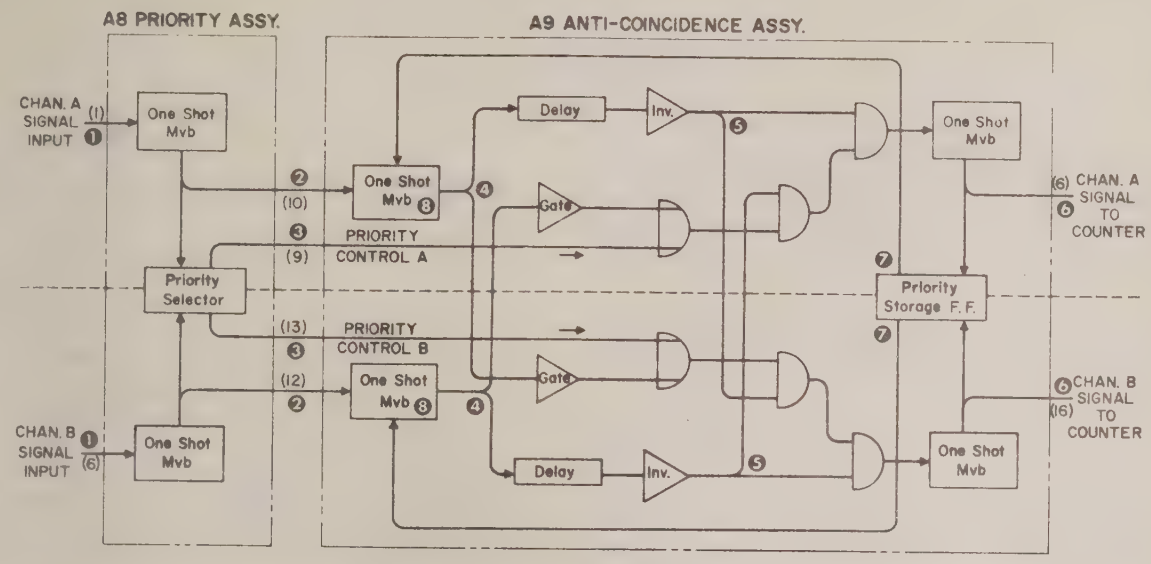
4-35. The Channel B input signal (waveform 2B) drives the Channel B driver amplifier (A9Q2). The resulting negative transition triggers the one-shot (A9Q4, A9Q6, A9Q8) by turning on A9Q6 and A9Q8, providing the one-shot output (waveform 4B). The one-shot is held in its astable state by the control signal (waveform 8B) from the priority storage flip-flop. The control signal controls the charging rate of A9C6 holding the Channel B one-shot in its astable state until after the Channel A one-shot has returned to its stable state.

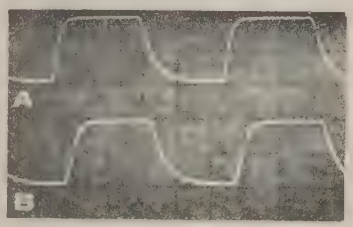
4-36. The output of A9Q7 which is a negative transition drives the Channel A gating amplifier (A9Q9) and the Channel A inverting amplifier (A9Q10). The output from A9Q9 is a positive transition applied to the base of A9Q14 holding the gated oneshot (A9Q14, A9Q16) in its stable state which blocks the Channel B signal path. The output from A9Q10 (waveform 5A) is a delayed positive transition due to the delay network. It is also applied to the base of A9Q14 holding it on and further blocking the Channel B signal path. At the same time, the A9Q10 output back biases A9CR15 which causes the one-shot (A9Q13, A9Q15) to switch to its astable state. The one-shot was triggered by the A priority control signal (waveform 3A) which was applied to the base of A9Q13, turning it off.

4-37. The output of A9Q8 which is a negative transistion (waveform 4B) drives the Channel B gating amplifier (A9Q11) and the Channel B inverting amplifier (A9Q12). A9Q11 does not conduct until the A priority control signal returns to a positive level. The output of A9Q12 (waveform 5B) is a positive transition that back biases A9CR16 and starts the Channel B one-shot into its astable state.

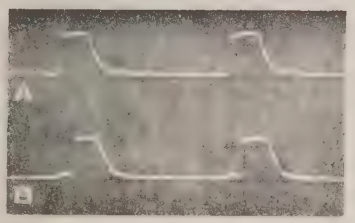
4-38. The output of A9Q15 is a negative transition that is the Channel A output (waveform 6A) to the counter and triggers the priority flip-flop (A9Q17, A9Q18) by turning A9Q18 on and A9Q17 off. The output of A9Q18 (waveform 7B) controls the charging rate of A9C6.

4-39. After the Channel A one-shot (A9Q3, A9Q5) returns to its stable state, the outputs of A9Q9 and A9Q10 switch to a negative level. A9Q14 is switched to its astable state and A9Q16 conducts. The output of A9Q16 (waveform 6B) is a negative transition that is the Channel B output to the Counter and triggers the priority storage flip-flop (A9Q17, A9Q18) by turning on A9Q17 and turning off A9Q18. The output from A9Q17 (waveform 7A) controls the charging rate of A9C5.



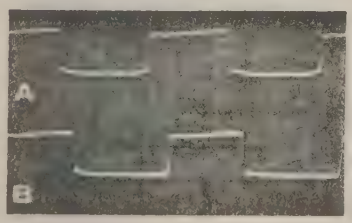


❶ A and B inputs to A8



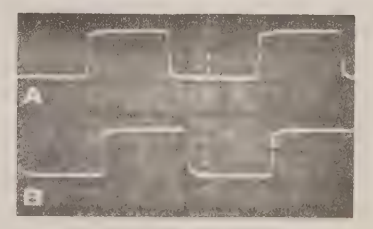
❷ A and B inputs to A9

❸ Priority control signals

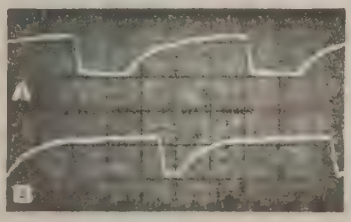


❹ One shot multivibrator outputs

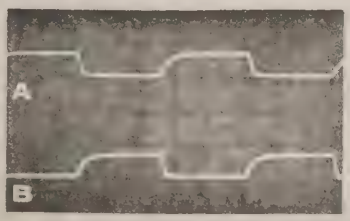
HP 175A Oscilloscope
HP 1750B Vertical Amplifier
Vertical Sensitivity = 10V/cm
Horizontal Sweep = 200 ns/cm
External Sync to
Trigger Output A5(1)



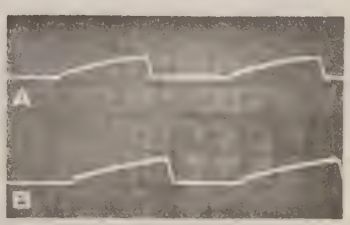
❺ Inverting amplifier outputs



❻ A and B signals to counter



❼ Priority storage flip-flop outputs



❽ Control signals

Figure 4-4. Logic Diagrams and Waveforms, A8, A9

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section provides maintenance and service information for the Model 5285A Electronic Counter. Included are a table of recommended test equipment, repair and adjustment procedures, and an in-cabinet performance check which may be used to verify proper operation of the Counter.

5-3. ASSEMBLY DESIGNATIONS AND CONNECTION IDENTIFICATION.

5-4. Table 5-1 gives the reference designations of all printed circuit assemblies used in the Plug-in and their corresponding nomenclature. Throughout the manual, connections to printed circuit assemblies are referred to in abbreviated form. For example, the connection to pin 5 of Assembly A6 is A6(5).

Table 5-1. Assembly Designations

A1	Attenuator Assembly (Input A)
A2	Attenuator Assembly (Input B)
A3	Differential Amplifier Assembly (Input A)
A4	Differential Amplifier Assembly (Input B)
A5	Trigger Amplifier Assembly (Input A)
A6	Trigger Amplifier Assembly (Input B)
A7	Directional Control Assembly
A8	Priority Assembly
A9	Anti-coincidence Assembly

5-5. TEST EQUIPMENT

5-6. Recommended test equipment for performance checking, troubleshooting, and repair is listed in Table 5-2. Other test instruments may be used if their specifications equal or exceed the required characteristics.

5-7. IN-CABINET PERFORMANCE CHECK.

5-8. GENERAL. The In-Cabinet Performance Checks, Table 5-3, and Performance Check Test Card (to be filled out during incoming inspection) page 5-6a, verify specifications and provide a permanent record of the performance of each instrument.

CAUTION

TO AVOID DAMAGE, REMOVE POWER FROM COUNTER BEFORE REMOVING OR REPLACING PLUG-IN ASSEMBLIES OR COMPONENTS.

5-9. TROUBLESHOOTING AND REPAIR

5-10. SUBSTITUTION. Troubleshooting may be greatly simplified if checking is done by replacing assembly suspected of malfunction with spare assembly known to be operating correctly. When the malfunctioning assembly is found, trouble then may be traced to individual components responsible for malfunction, or the malfunctioning assembly may be shipped to your Hewlett-Packard field office for repair.

5-11. TROUBLESHOOTING OF ASSEMBLIES. Refer to Section IV, Principles of Operation, for information on the operation of circuits. Table 5-2 gives the reference designations of all assemblies used in the Counter and their corresponding nomenclature. Figure 5-2 shows the location of all assemblies used in Model 5285A. Table 5-4, Troubleshooting Aids, provides a procedure to help isolate the faulty assembly. For easy access to assembly circuits during operation, use the printed circuit assembly extension provided with each counter.

5-12. PRINTED CIRCUIT COMPONENT REPLACEMENT. Component lead holes in the Model 5285A circuit boards have plated walls to ensure good electrical contact between conductors on the opposite sides of the board. To prevent damage to this plating and to the replacement component, apply heat sparingly and work carefully. The following replacement procedure is recommended.

a. Remove defective component.

b. Melt solder in component lead holes. Use clean dry soldering iron to remove excess solder. Clean holes with toothpick or wooden splinter. Do not use metal tool for cleaning as this may damage through-hole plating.

c. Bend lead of replacement component to correct shape and insert component leads into component lead holes. Using heat and solder sparingly, solder leads in place. Heat may be applied to either side of the board. A heat sink (longnose pliers, commercial heat-sink tweezers, etc.) should be used when replacing transistors and diodes in order to prevent conduction of excessive heat from the soldering iron to the component.

d. Through-hole plating breaks are indicated by the separation from the board of the round conductor pad on either side of the board. To repair breaks, press conductor pads against board and solder replacement component lead to conductor pad on both sides of the board.

5-13. DIFFERENTIAL AMPLIFIER ZERO LEVEL ADJUSTMENT.

5-14. CHANNEL A ZERO ADJUSTMENT.

a. Set Counter controls as follows:

DC VOLTS/AC VOLTS . . . . . .DC VOLTS X1
LEVEL A 0

Table 5-2. Recommended Test Equipment

Instrument Type	Required Characteristics	Use	Instrument Recommended
Oscilloscope	50-MHz bandwidth, four channel plug-in, ext sync capability	Observe waveforms during troubleshooting, adjustment, and performance check	HP Model 175A Oscilloscope HP Model 1754A 4-Channel Vertical Amplifier HP 1780A Horizontal Auxiliary Plug-In HP 10003A Voltage Divider Probe (4)
Test Oscillator	Continuously variable from 10 Hz to 2 MHz, 100 mV to 1 V output	Performance check	HP Model 651A Test Oscillator
Low Frequency Generator	Continuously variable from 2 Hz to 10 Hz, 100 mV output	Performance check	HP Model 203A Low Frequency Function Generator
Pulse Generator	1 μsec wide, 1V neg or pos, 1 kHz repetition rate		HP Model 222A Pulse Generator
DC Voltmeter	±.1V to ±300V full scale, 10 megohm impedance, 1% accuracy	Troubleshooting and adjustments	HP Model 412A
Frequency Doubler	500 kHz minimum input	Performance check	HP Model 10515A
BNC-T Adapter		Performance check	HP Part No. 1250-0072
50-Pin Extender Cable		Troubleshooting and adjustment	HP Model 10506B
Preset Counter	100 kHz Time Base .1s and 1 sec gate times	Performance check	HP Model 5214L
Phase Shift Network	See Table 5-3, step 7c	Performance check and adjustments	
Reversible Counter		Performance check, adjustments, and troubleshooting	HP Model 5280A

b. Connect DC Voltmeter to the Channel A input BNC.

c. Adjust R4 (Figure 5-2) to obtain a reading on the DC Voltmeter of 0 volts ±0.1 Vdc.

5-15. CHANNEL B ZERO ADJUSTMENT. Repeat the procedure used for Channel A zero adjustment (Paragraph 5-14) adjusting R7 (Figure 5-2) for a DC Voltmeter reading of 0 volts ±0.1 Vdc.

5-16. ADJUSTING OF A8 PRIORITY AND A9 ANTI-COINCIDENCE ASSEMBLIES.

5-17. The priority assembly A8 and the anti-coincidence assembly A9 are checked together for proper alignment of anti-coincidence operation. If any repairs, adjustments, or replacements are made to either assembly, both must be checked for priority error and primary to secondary pulse spacing.

5-18. The following is the test procedure for the proper alignment of the anticoincidence circuitry. Refer to Figures 8-7 and 8-8 for component locations.

CAUTION

Extreme care should be taken when making checks as a shorted component can cause serious damage to both assemblies. The power should be turned off when connecting or disconnecting a test probe.

a. Set Plug-in and Reversible Counter as follows:

MODES . . . . . A - B and +
DC VOLTS/AC VOLTS both channels DC VOLTS X1
GATE CONTROL . . . . . MANUAL OPEN

Plug-in is connected with a 50-pin extender cable (HP Part No. 10506B).

b. Connect Oscilloscope as follows:

Trace #1	A INPUT	A8(10)
Trace #2	B INPUT	A8(12)
Trace #3	A OUTPUT	A9(6)
Trace #4	B OUTPUT	A9(16)

c. Apply two 1 MHz signals to the A and B INPUTS. The B signal should have a phase shift network. Adjust the phase shift and the TRIGGER LEVELS until A and B pulses are spaced 0.5 μ sec as shown in Figure 5-1A. The input pulses should be 170 +20 -0 nsec wide. If either input pulse is out of this range, select proper padding resistors to obtain correct pulse width, A8R9 for Channel A and A8R11 for Channel B. Check that there is one output pulse for each input pulse.

Note

All pulse spacings refer to the leading edge of the pulses only. The trailing edge of the pulses is significant only when defining pulse width.

d. To align the Priority Selector, the phase shift network is adjusted so A and B input pulses are spaced approximately 60 nsec apart. Note that one of the two output pulses occurs within 170 nsec after the corresponding input pulse (referred to as the "primary pulse"). The other pulse (referred to as the "secondary pulse") is delayed approximately 550 nsec.

e. When input spacing is decreased from +60 nsec through coincidence to -60 nsec, the priority status will change. The primary pulse then becomes the secondary pulse and vice versa. At the critical input pulse spacing which will be referred to as priority crossover, the priority will change back and forth randomly, causing "priority jitter". If output pulses are incorrect, temporarily substitute a 10K resistor for A9R21; try different values for A9R21 until the correct pulse is obtained.

f. At priority crossover, note which input pulse occurs first. Set vertical sensitivity of Traces 1 and 2 to 0.2V/cm and center them on graticule, intersecting the horizontal center line at half amplitude. Set vertical sensitivity of Traces 3 and 4 to 0.5 V/cm. Refer to Figure 5-1B.

g. If the A input pulse occurs prior to the B input pulse, align the Priority Selector by choosing a correct value for A8R21. If the B input pulse is first, choose correct value for A8R24. Start with an 8.2K ohm resistor and select the proper value to minimize input pulse spacing at priority crossover. Incorrect pulse spacing is called priority error. Proceed by inserting resistor, adjusting input pulse spacing to priority crossover, and reading the priority error. For priority error readings below 15 nsec, use extended sweep. The Priority Selector is aligned when priority error is less than 5 nsec. Figure 5-1C shows priority error before alignment while Figure 5-1D shows priority error after the alignment procedure is complete. Recheck priority whenever a component is added or changed.

h. To adjust the primary pulses, set Traces 1 and 2 (A and B inputs) to 1.0V/cm. Set Traces 3 and 4 (A and B outputs) to 0.2V/cm. Set the sweep speed to 0.1 μs/cm. Center Traces 3 and 4 on graticule, intersecting the horizontal center line at half amplitude. Note that at priority crossover B primary pulse will occur first and is wider. See Figure 5-1E.

i. Starting with A9R21, 10K ohms, check for less than 5 nsec spacing between primary pulses. Use a sweep speed of 0.01 μs/cm. See Figure 5-1F. Adjust value of A9R21 as needed to obtain correct spacing.

j. To adjust the primary to secondary pulse spacing, change the phase shift network so that A input pulse is approximately 40 nsec ahead of B input pulse. At the outputs, the A pulse is now primary and the B pulse is secondary. Starting with A9R17, 22K ohms, insert a proper resistor to align output spacing between A and B pulse to 480 ± 10 nsec. Trigger the Oscilloscope from the A input pulse for this adjustment. See Figure 5-1G. If the pulse spacing is too wide, increase the value of A9R17. If the spacing is too narrow, decrease the value.

CAUTION

When soldering A9R17 and A9R18 be careful not to heat the board too much as this will affect the characteristics of the thermistors A9RT1 and A9RT2. Checking pulse spacing is meaningless until the resistor has returned to normal temperature.

k. Set B input pulse approximately 40 nsec ahead of A input pulse. Now, at the outputs, B pulse is primary and A pulse is secondary. Repeat step j, substituting for A9R18. Trigger Oscilloscope from the B input pulse (see Figure 5-1H).

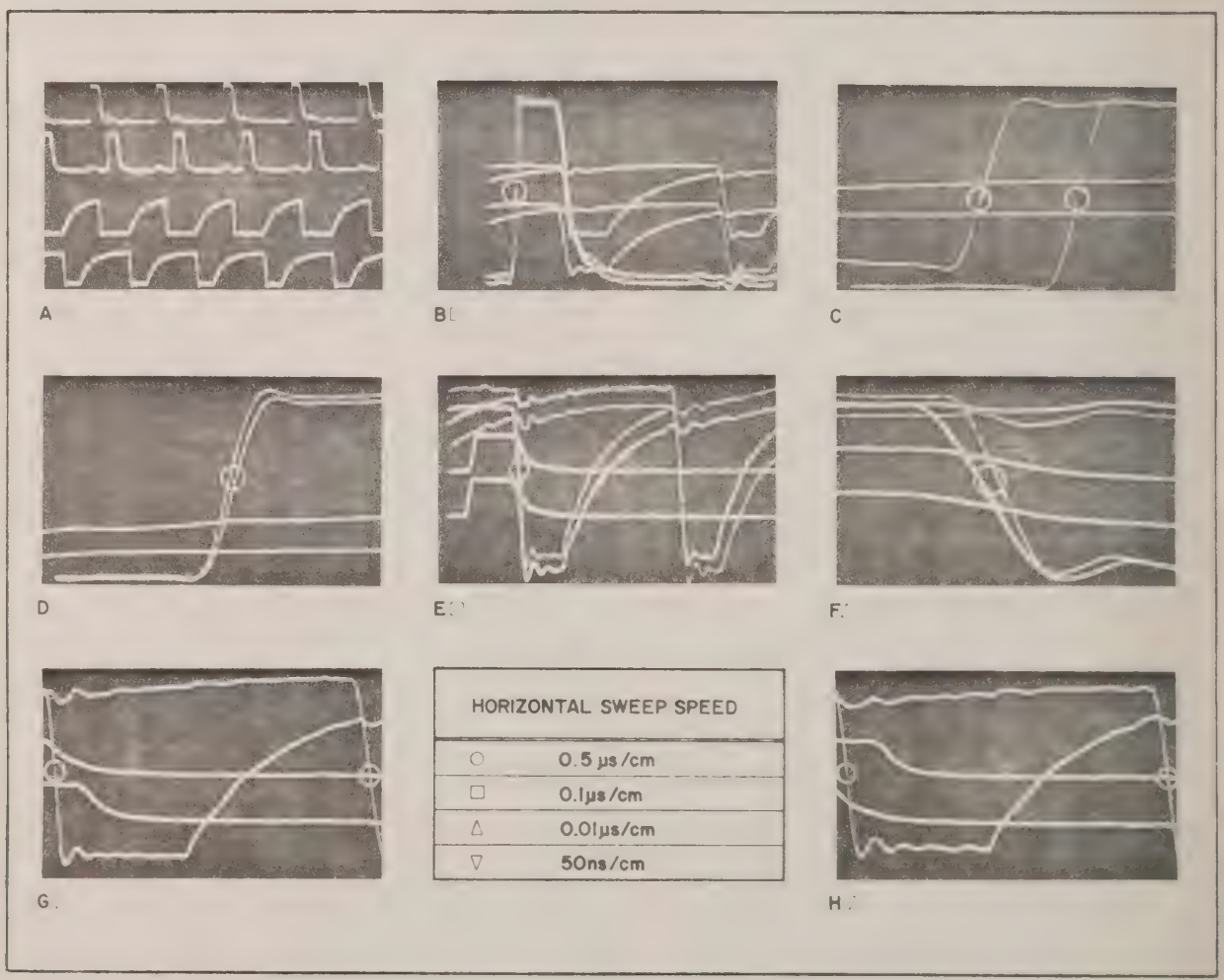


Figure 5-1. A8 and A9 Test Waveforms

Table 5-3. In-Cabinet Performance Check
(5280A/5285A)

1. RANGE: Dc coupled 0 to 2 MHz. Ac coupled 10 Hz to 2 MHz

CHANNEL A INPUT:

a. Set Plug-in and Reversible Counter controls as follows:

DC VOLTS/AC VOLTS . . . . . DC VOLTS X1
MODES. . . . . A and +
GATE CONTROL . . . . . EXTERNAL DUAL

b. Set Preset Counter (5214L) controls as follows:

SENSITIVITY . . . . . .CHECK
FUNCTION . . . . . RATE
MULTIPLIER X1
SAMPLE RATE slightly clockwise
out of POWER OFF
Preset N Switches 00000

Connect START and STOP outputs to START and STOP inputs on Counter

c. Connect output of Low Frequency Generator to INPUT A of the Plug-in and to one input of the Oscilloscope with a BNC "T" connector. The Oscillsocope is used to monitor input signal level. Set Low Frequency Generator output for 0.1V rms (0.28 V peak-to-peak).

d. Adjust Plug-in LEVEL A control to trigger on input signal.

e. Vary frequency of Low Frequency Generator from 2 Hz to 1200 Hz, keeping output constant at 0.1V rms (0.28V peak-to-peak). Counter should display an increasing total at a 1 second rate.

f. Substitute Test Oscillator for Low Frequency Generator.

g. Change Preset Counter (5214L) Preset N switches to 10000 and SAMPLE RATE to HOLD. Set Counter Gate control to EXTERNAL DUAL. Gate time is 0.1 sec; 1200 Hz will display 120.

h. Vary Test Oscillator from 1200 Hz to > 2 MHz, keeping output constant at 0.1V rms (0.28 V peak-to-peak). Record range determined by steps e and h on Performance Check Test Card.

i. Set Plug-in DC VOLTS/AC VOLTS switch to AC VOLTS X1.

j. Vary Test Oscillator frequency from 10 Hz to > 2 MHz, keeping output constant at 0.1 V rms (0.28V peak-to-peak).

k. Repeat the procedure given for Channel A in steps a through j with the input signal connected to the Channel B input, and the MODE switches set to B and +. Record range on Performance Check Test card.

2. SENSITIVITY: 0.1 V rms sine wave; 1 volt pulse, 0.2 μsec minimum width.

a. Sine wave sensitivity specification is verified by procedure 1, RANGE check.

b. Set Plug-in and Reversible counter controls as follows:

DC VOLTS/AC VOLTS . . . . . DC VOLTS X1
MODES. . . . . A and +
GATE CONTROL . . . . . EXTERNAL DUAL

Table 5-3. In-Cabinet Performance Check (cont'd)

c. Set Preset Counter (5214L) controls as follows:

SENSITIVITY	CHECK
FUNCTION	RATE
MULTIPLIER	X1
SAMPLE RATE slightly clockwise out of	POWER OFF
Preset N switches	10000

d. Connect output of Pulse Generator to INPUT A of the plug-in and to input of Oscilloscope with BNC "T" connector. The oscilloscope is used to monitor input signal level.

e. Set Pulse Generator for 0.2 μs, 1 volt negative or positive pulse at a repetition rate of 1 kHz.

f. Adjust Plug-in LEVEL A control to trigger on pulses. Counter will increase total at 1 kHz rate.

g. Reduce Pulse Generator output level, and record on test card the lowest level at which the Counter will count. LEVEL A control can be adjusted to obtain optimum trigger at lower input level.

h. Repeat the procedure given for Channel A in steps a through g with the input signal connected to the Channel B INPUT and the MODE switches set to B and +.

3. TRIGGER LEVEL: -100 to +100 volts, adjustable either positive or negative slope; independent controls on each channel.

a. Set Plug-in and Reversible Counter controls as follows:

DC VOLTS/AC VOLTS	AC VOLTS X1
MODES	A and +
LEVEL A	+1
GATE CONTROL	EXTERNAL DUAL

b. Set Preset Counter (5214L) controls as follows:

SENSITIVITY	CHECK
FUNCTION	RATE
MULTIPLIER	X1
SAMPLE RATE slightly clockwise out of	POWER OFF
Preset N switches	10000

c. Connect output of Test Oscillator to Channel A input. Set Test Oscillator for an input signal of 1 kHz at 1 volt rms (2.8 volts peak-to-peak).

d. Connect Oscilloscope to MONITOR A output on rear panel of Counter.

e. Reduce input signal level. Monitor output as observed on Oscilloscope should disappear when input signal is 0.7 volts rms ± 0.2V rms (2V peak-to-peak ± 0.5V peak-to-peak). Record this level on the test card.

f. Set LEVEL A to -1 and repeat step e.

g. Repeat above procedure for Channel B and record the level on the test card.

Note this procedure verifies the proper operation of the trigger level controls with the attenuators in the X1 position. In the X10 and X100 positions the input signal is attenuated by factors of 10 and 100, permitting the same trigger level control as in the X1 position for signals up to 10 volts in the X10 position and up to 100 volts in the X100 position.

Table 5-3. In-Cabinet Performance Check (cont'd)

4. A and B MODES: Counts A only or B only to 2 MHz.

Counting range specification is verified by procedure 1, RANGE check.

5. A - B MODE: Input A minus Input B; to 1 MHz for both A and B.

a. Set up Plug-in and Reversible Counter as shown in Figure 3-3.

b. Set up Preset Counter (5214L) as follows:

SENSITIVITY . . . . . .CHECK
FUNCTION . . . . . RATE
MULTIPLIER X1
SAMPLE RATE slightly clockwise out of . . . . . .POWER OFF
Preset N Switches 10000

c. Set the Reversible Counter GATE CONTROL to EXTERNAL DUAL and the Plug-in polarity MODE switch to +.

d. Connect 1 MHz signal to A INPUT only. Reversible Counter should totalize in a positive direction.

e. Connect 1 MHz signal to B INPUT only. Reversible Counter should totalize in a negative direction (increasing magnitude, - sign).

f. Connect 1 MHz signal to both inputs and reset the Counter. Counter display should not change. This indicates the Counter is adding and subtracting equal signals.

g. Connect 500 kHz signal through a 10515A Doubler using a 50-ohm source and a 50-ohm load to A INPUT and 500 kHz to B INPUT. Counter should totalize positive.

h. Connect 500 kHz signal to A INPUT and 500 kHz through a 10515A Doubler to B INPUT. Counter should totalize negative.

i. Reverse the MODE switch polarity. Repeat steps g and h. Direction of totalizing should be reversed. Mark Performance Check Test Card OK in appropriate squares when steps g and h are satisfactorily completed for both + and - polarities.

6. A + B MODE: Input A plus Input B; to 1 MHz for both A and B.

a. Set up Plug-in and Reversible Counter as shown in Figure 3-4.

b. Set up Preset Counter (5214L) as in Check 5, A-B MODE.

c. Set the Reversible Counter GATE CONTROL to EXTERNAL DUAL and the Plug-in polarity MODE switch to +.

d. Connect a 1 MHz Signal to the A and B INPUTS. Reset the Counter.

e. Counter should totalize in a positive direction.

f. Change polarity MODE switch to - and reset the Counter.

g. Counter should totalize in a negative direction (increasing magnitude - sign). Mark Performance Check Test Card OK in appropriate squares when steps e and g are satisfactorily completed for both + and - polarities.

7. A QUAD B MODE: Two inputs separated 90° in phase. Maximum rate each channel, 1 MHz.

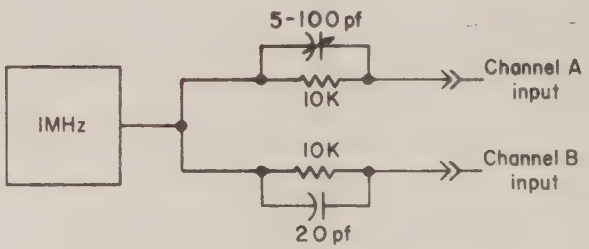
a. Set Plug-in and Reversible Counter as shown in Figure 3-5.

Table 5-3. In-Cabinet Performance Check (cont'd)

b. Set Preset Counter (5214L) as follows:

SENSITIVITY . . . . . CHECK
FUNCTION . . . . . RATE
MULTIPLIER X1
SAMPLE RATE slightly clockwise out of . . . . . POWER OFF
Preset N switches 10000

c. Connect 1 MHz signal 1V rms to phase shift network as shown below as close to the input connectors as possible.



d. Vary capacitor from minimum to maximum. Observe phase shift on Oscilloscope.

e. Counter totalizes A positively if A lags B. Mark Performance Check Test Card OK in appropriate square when that test is satisfactorily completed.

8. Af(B) MODE: Counts A as a function of B from dc to 2 MHz.

a. Set Plug-in and Reversible Counter as follows:

Channel A:
DC VOLTS/AC VOLTS . . . . . DC VOLTS X1
LEVEL A . . . . . adjust for constant count
A INPUT . . . . . 2 MHz

Channel B:
DC VOLTS/AC VOLTS . . . . . DC VOLTS X10
LEVEL B . . . . . variable
B INPUT . . . . . no signal

GATE CONTROL . . . . . EXTERNAL DUAL

b. Set Preset Counter (5214L) as follows:
SENSITIVITY . . . . . CHECK
FUNCTION . . . . . RATE
MULTIPLIER X1
SAMPLE RATE slightly clockwise out of . . . . . POWER OFF

Preset "N" switches. 10000

c. Vary LEVEL B control from + to -. This will reverse the counting direction. Polarity of level control will be opposite the true counting direction indicated by the Reversible Counter.

Hewlett-Packard Model 5285A
Instrument Serial No. _____

Tests performed by _____

Date _____

PERFORMANCE CHECK TEST CARD

Description	Check
1. RANGE: Dc coupled: dc to 2 MHz Channel A: 2 Hz to 2 MHz Channel B: 2 Hz to 2 MHz Ac coupled: 10 Hz to 2 MHz Channel A: 10 Hz to 2 MHz Channel B: 10 Hz to 2 MHz	☐ 2 Hz to 2 MHz minimum ☐ 2 Hz to 2 MHz minimum ☐ 10 Hz to 2 MHz minimum ☐ 10 Hz to 2 MHz minimum
2. SENSITIVITY: 0.1 volt rms sine wave 1 volt pulse, 0.2 μs minimum width.	☐ 0.1V rms (verified by Range Check) ☐ 1V peak or less (@ 1 kHz) 0.2 μs or less
3. TRIGGER LEVEL: -100 to +100 volts, adjustable, either positive or negative slope; independent controls on each channel.	
LEVEL A + 1, Attenuator X1 position	☐ V rms should be .7 ± .2V rms
LEVEL A - 1, Attenuator X1 position	☐ V rms should be .7 ± .2V rms
LEVEL B + 1, Attenuator X1 position	☐ V rms should be .7 ± .2V rms
LEVEL B - 1, Attenuator X1 position	☐ V rms should be .7 ± .2V rms
4. A and B MODES: Counts A only or B only to 2 MHz	☐ Dc to 2 MHz (verified by Range Check)
5. A - B MODE: Input A minus Input B; to 1 Mhz for both A and B	
A - B : A signal larger than B signal	☐ totalizes positive
A - B : B signal larger than A signal	☐ totalizes negative
6. A + B MODE: Input A plus Input B; to 1 MHz for both A and B	
A + B: MODE switch +	☐ totalizes negative
A + B: MODE switch -	☐ totalizes negative
7. A QUAD B: Two inputs separated 90° in phase; max rate each channel 1 MHz	
A QUAD B: A leads B	☐ totalizes positive
A QUAD B: B leads A	☐ totalizes negative
8. Af(B) MODE: Counts A as a function B from dc to 2 MHz	
Af(B) with B signal positive	☐ totalizes positive
Af(B) with B signal negative	☐ totalizes A negative

Table 5-4. Troubleshooting Aids

1. POWER SUPPLY. Measure power supply voltages as shown below:

Pin No.	Voltage
P1[illegible]	-20V
P1[illegible]	-13V
P1[illegible]	-15V

2. INPUT ATTENUATOR, DIFFERENTIAL AMPLIFIER, and TRIGGER AMPLIFIER (A1, A3, A5 Channel A; A2, A4, A6 Channel B)

a. Remove Plug-in and use extender cable (HP Part No. 10506B).

b. Set Plug-in controls as follows:

DC VOLTS AC VOLTS. . . . . AC VOLTS X1
LEVEL A AND LEVEL B 0
MODES. . . . . A and +

c. Connect Test Oscillator to Channel A input.

d. Set Test Oscillator for an input signal of 1 MHz at 0.1V rms, and make the following test 1, 2, & 3.

e. Connect Test Oscillator to Channel B input, set MODES switch to B and +, and make the following test 4, 5 & 6.

Test	To Check	Connect Oscilloscope to:	Proper Indication
1	A1, A3	XA3 (1)	1 MHz 1.3V peak-to-peak
2	A1, A3	XA3 (A)	1 MHz 0.7V peak-to-peak
3	A1, A3, A5	XA5 (1)	1 MHz 18V peak-to-peak rect. wave
4	A2, A4	XA4 (1)	1 MHz 1.3V peak-to-peak
5	A2, A4	XA4 (A)	1 MHz 0.7V peak-to-peak
6	A2, A4, A6	XA6 (1)	1 MHz 18V rectangular wave

3. DIRECTIONAL CONTROL (A7), PRIORITY (A8), and ANTICOINCIDENCE (A9)

a. Set Plug-in controls as follows:

DC VOLTS AC VOLTS. . . . . AC VOLTS X1
LEVEL A and LEVEL B. 0
MODES . . . . . A and +

b. Connect Test Oscillator to A and B inputs with a BNC "T" connector.

c. Set Test Oscillator for an input signal of 1 MHz at 0.1V rms, and make the following test 1, 2, & 3.

d. Set MODES switches to B and + and make the following test 4, 5 & 6.

Test	To Check	Connect Oscilloscope to:	Proper Indication
1	A7	XA7 (1)	Negative pulses at 1 MHz rate
2	A7	XA7 (3)	No pulses
3	A8	XA8 (9 and 10)	No pulses
4	A7	XA7 (3)	Negative pulses at 1 MHz rate
5	A7	XA7 (1)	No pulses
6	A8	XA8 (12 and 13)	No pulses

e. Remove input signal from Channel B and set MODE switch to A-B. Channel A has 1 MHz input signal.

f. Make tests 7 through 12. Then set MODE switch to A + B and repeat the tests.

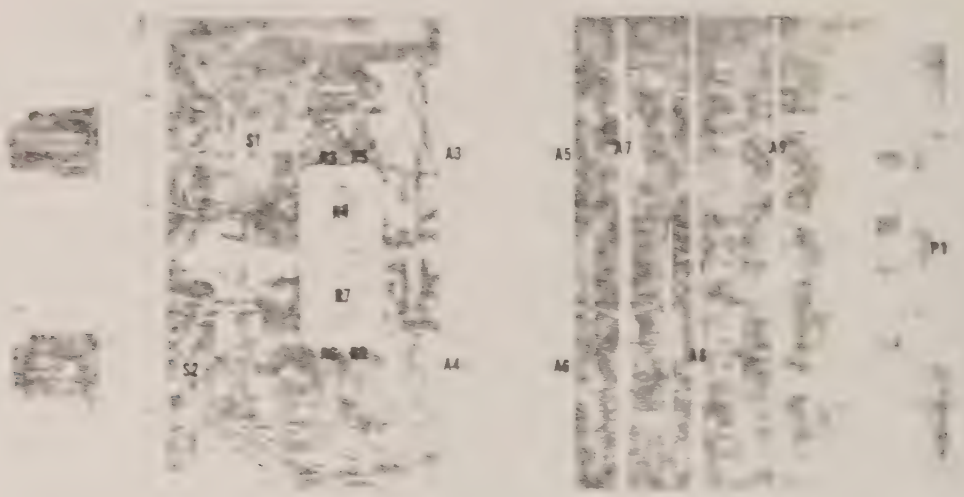
g. Remove input signal from Channel A and connect it to Channel B.

Table 5-4. Troubleshooting Aids (cont'd)

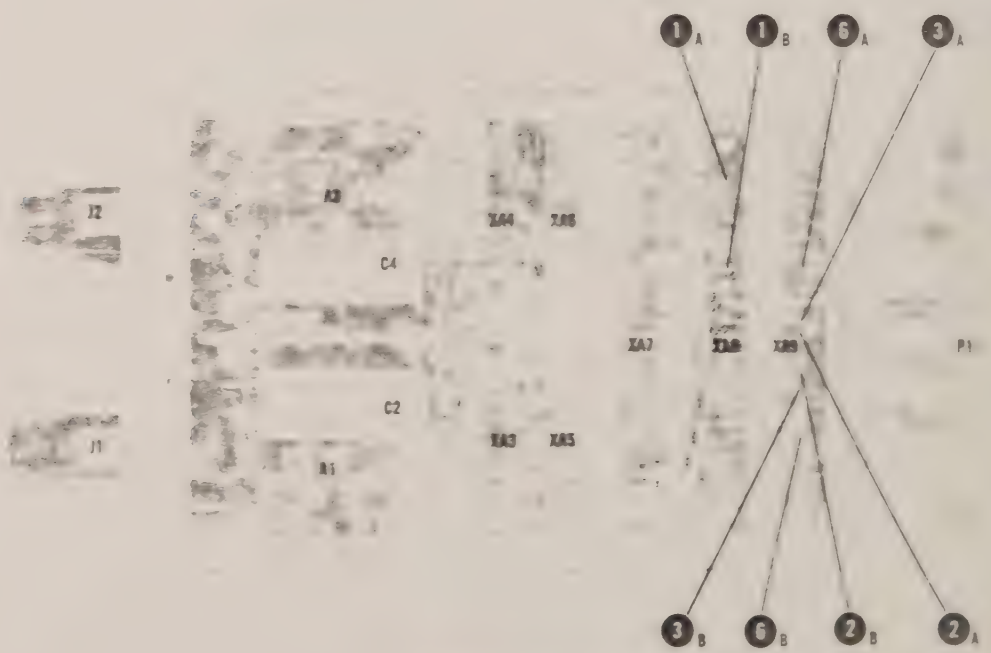
3. DIRECTIONAL CONTROL (A7), PRIORITY (A6) and ANTICOINCIDENCE (A9) continued

h. Make tests 13 through 18. Then set MODE switch to A-B and repeat tests.

Test	To Check	Connect Oscilloscope to:	Proper Indication
7	A8	XA8 (10)	Positive pulses
8	A8	XA8 (12)	No pulses
9	A8	XA8 (9)	Negative pulses
10	A8	XA8 (13)	No pulses
11	A9	XA9 (6)	Negative pulses
12	A9	XA9 (16)	No pulses
13	A8	XA8 (10)	No pulses
14	A8	XA8 (12)	Positive pulses
15	A8	XA8 (9)	No pulses
16	A8	XA8 (13)	Negative pulses
17	A9	XA9 (6)	No pulses
18	A9	XA9 (16)	Negative pulses



TOP INTERNAL



BOTTOM INTERNAL

Figure 5-2. Top and Bottom Internal Views

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. Table 6-1 lists parts in alpha-numerical order of their reference designators and indicates the description and HP part number of each part, together with any applicable notes. Table 6-2 lists parts in alpha-numerical order of their HP part number and provides the following information on each part;

a. Description of part (see abbreviations below).

b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in Table 6-3.

c. Manufacturer's part number.

d. Total quantity used in the instrument (TQ column).

6-3. Miscellaneous parts are listed at the end of Table 6-1.

6-4. ORDERING INFORMATION

6-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Sales and Service office (see lists at rear of this manual for addresses). Identify parts by their Hewlett-Packard part numbers.

6-6. To obtain a part that is not listed, include:

a. Instrument model number.

b. Instrument serial number.

c. Description of the part.

d. Function and location of the part.

REFERENCE DESIGNATORS

A	assembly	F	fuse	MP	mechanical part	U	
B	motor	FL	filter	P	plug	V	
BT	battery	IC	integrated circuit	Q	transistor		
C	capacitor	J	jack	R	resistor	VR	
CP	coupler	K	relay	RT	thermistor	W	
CR	diode	L	inductor	S	switch	X	
DL	delay line	LS	loud speaker	T	transformer	Y	
DS	device signaling (lamp)	M	meter	TB	terminal board	Z	
E	misc electronic part	MK	microphone	TP	test point		

ABBREVIATIONS

A	amperes	H	henries	N/O	normally open	RMO	
AFC	automatic frequency control	HDW	hardware	NOM	nominal	RMS	root-mean square
AMPL	amplifier	HEX	hexagonal	NPO	negative positive zero (zero temperature coefficient)	RWV	reverse working voltage
		HG	mercury				
BFO	beat frequency oscillator	HR	hour(s)	NPN	negative-positive-negative	S-B	slow-blow
BE CU	beryllium copper	HZ	hertz			SCR	screw
BH	binder head			NRFR	not recommended for field replacement	SE	selenium
BP	bandpass	IF	intermediate freq			SECT	section(s)
BRS	brass	IMPG	impregnated	NSR	not separately replaceable	SEMICON	semiconductor
BWO	backward wave oscillator	INCD	incandescent			SI	silicon
		INCL	include(s)			SIL	silver
CCW	counter-clockwise	INS	insulation(ed)	OBD	order by description	SL	slide
CER	ceramic	INT	internal	OH	oval head	SPG	spring
CMO	cabinet mount only	K	kilo 1000	OX	oxide	SPL	special
COEF	coefficient			P	peak	SST	stainless steel
COM	common	LH	left hand	PC	printed circuit	SR	split ring
COMP	composition	LIN	linear taper	PF	picofarads 10^{-12} farads	STL	steel
COMPL	complete	LK WASH	lock washer				
CONN	connector	LOG	logarithmic taper	PH BRZ	phosphor bronze		
CP	cadmium plate	LPF	low pass filter	PHL	Phillips		
CRT	cathode-ray tube			PIV	peak inverse voltage	THD	
CW	clockwise	M	milli 10^{-3}	PNP	positive-negative-positive	TI	
		MEG	meg 10^{6}			TOL	
DEPC	deposited carbon	MET FLM	metal film	P/O	part of	TRIM	
DR	drive	MET OX	metallic oxide	POLY	polystyrene	TWI	
ELECT	electrolytic	MFR	manufacturer	PORC	porcelain		
ENCAP	encapsulated	MHZ	mega hertz	POS	position(s)	U	micro 10^{-6}
EXT	external	MINAT	miniature	POT	potentiometer	VAR	
F	farads	MOM	momentary	PP	peak-to-peak	VDCW	
FH	flat head	MOS	metal oxide substrate	PT	point		
FIL H	fillister head	MTG	mounting	PWV	peak working voltage	W	
FXD	fixed	MY	"mylar"			W	watts
G	giga (10^{9})	N	nano (10^{-9})	RECT	rectifier	WIV	working inverse voltage
GE	germanium	N/C	normally closed	RF	radio frequency	WW	wirewound
GL	glass	NE	neon	RH	round head or right hand	W/O	without
GRD	ground(ed)	NI PL	nickel plate				

01194-14

Table 6-1. Reference Designation Index

Reference Designation	Stock No.	Description #	Note
A1	5233L-19B	SWITCH ASS'Y.- ATTEN.	
A1C1	0140-0225	C:FXD MICA 300PF 1% 300VDCW	
A1C2	0160-0196	C:FXD MICA 24PF 5% 300VDCW	
A1C3	0150-0045	C:FXD TI 8.2 PF 5% 500 VDCW	
A1C4	0140-0151	C:FXD MICA 820PF 2% 300VDCW	
A1C5	0140-0198	C:FXD MICA 200PF 5% 300VDCW	
A1C6	0140-0152	C:FXD MICA 1000 PF 5% 300 VDCW	
A1C7	0140-0151	C:FXD MICA 820PF 2% 300VDCW	
A1C8	0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	
A1R1	0758-0070	R:FXD MET OX 1200 OHM 5% 1/2W	
A1R2	0686-1055	R:FXD COMP 1 MEGOHM 5% 1/2W	
A1R3	0686-1155	R:FXD COMP 1.1 MEGOHM 5% 1/2W	
A1R4	0758-0013	R:FXD MET OX 120 OHM 5% 1/2W	
A1R5	0758-0013	R:FXD MET OX 120 OHM 5% 1/2W	
A1R6		NSR PART OF S1	
A1R7	0758-0059	R:FXD MET OX 11K OHM 5% 1/2W	
A1R8	0758-0061	R:FXD MET OX 120K OHM 5% 1/2W	
A1R9	0758-0006	R:FXD MET OX 10K OHM 5% 1/2W	
A1R10	0758-0060	R:FXD MET OX 110K OHM 5% 1/2W	
A1R11	0758-0021	R:FXD MET OX 51K OHM 5% 1/2W	
A1S1	3100-0367	SWITCH:ROTARY 3 SECT 6 POS	
	0370-0100	KNOB:RED W/ARROW 1/2IN. OD 3/16 IN.SHAFT	
	0370-0101	KNOB:BLK CONCENTRIC 5/8IN. OD 1/4IN. SHAFT	
A1S2	0370-0100	KNOB:RED W/ARROW 1/2IN. OD 3/16 IN.SHAFT	
	0370-0101	KNOB:BLK CONCENTRIC 5/8IN. OD 1/4IN. SHAFT	
A2		SAME AS A1: USE PREFIX A2	
A3	5233L-65E	AMPLIFIER ASSY.	
	5233L-65E-1	BOARD- AMPLIFIER (BLANK BOARD)	
A3C1	0180-0116	C:FXD ELECT TA 6.8 UF 10% 35VDCW	
A3C2	0140-0221	C:FXD MICA 220PF 1% 300VDCW	
A3C3	0140-0221	C:FXD MICA 220PF 1% 300VDCW	
A3C4	0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	
A3CR1	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A3CR2	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A3CR3	1902-0048	SEMICON DEVICE:DIODE BREAKDOWN	
A3Q1	1851-0017	TRANSISTOR:2N1304	
A3Q2	1854-0014	TRANSISTOR:DUAL NPN SILICON	
A3Q3	1853-0003	TRANSISTOR:PNP SILICON F 50MC MIN	
A3Q4	1853-0003	TRANSISTOR:PNP SILICON F 50MC MIN	
A3Q5	1854-0003	TRANSISTOR:NPN SILICON	
A3Q6	1854-0003	TRANSISTOR:NPN SILICON	
A3R1	0758-0073	R:FXD MET OX 24K OHM 5% 1/2W	
A3R2	0758-0043	R:FXD MET OX 1800 OHM 5% 1/2W	
A3R3	0758-0042	R:FXD MET OX 1300 OHM 5% 1/2W	
A3R4	0758-0045	R:FXD MET OX 3900 OHM 5% 1/2W	
A3R5	0758-0074	R:FXD MET OX 27K OHM 5% 1/2W	
A3R6	0758-0100	R:FXD MET OX 330K OHM 5% 1/2W	

= See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	✞ Stock No.	Description #	Note
A3R7	0757-0270	RIFXD MET FLM 249K OHM 1% 1/8W	
A3R8	0758-0063	RIFXD MET OX 1600 OHM 5% 1/2W	
A3R9	0758-0018	RIFXD MET OX 15K OHM 5% 1/2W	
A3R10	0758-0031	RIFXD MET OX 680 OHM 5% 1/2W	
A3R11	0758-0031	RIFXD MET OX 680 OHM 5% 1/2W	
A3R12	0758-0018	RIFXD MET OX 15K OHM 5% 1/2W	
A3R13	0758-0045	RIFXD MET OX 3900 OHM 5% 1/2W	
A3R14	0758-0031	RIFXD MET OX 680 OHM 5% 1/2W	
A3R15	0758-0031	RIFXD MET OX 680 OHM 5% 1/2W	
A3R16	0758-0045	RIFXD MET OX 3900 OHM 5% 1/2W	
A3R17	0758-0033	RIFXD MET OX 2000 OHM 5% 1/2W	
A3R18	0758-0037	RIFXD MET OX 5100 OHM 5% 1/2W	
A3R19	0758-0031	RIFXD MET OX 680 OHM 5% 1/2W	
A3R20	0758-0031	RIFXD MET OX 680 OHM 5% 1/2W	
A3R21	0758-0045	RIFXD MET OX 3900 OHM 5% 1/2W	
A3R22	0758-0045	RIFXD MET OX 3900 OHM 5% 1/2W	
A3R23	0683-0275	RIFXD COMP 2.7 OHM 5% 1/4W	
A4		SAME AS A3; USE PREFIX A4	
A5	5233L-65F	TRIGGER ASS'Y,	
	5233L-65F-1	BOARD- TRIGGER(BLANK BOARD)	
A5C1	0160-0127	CIFXD CER 1UF 20% 25VDCW	
A5C2	0140-0195	CIFXD MICA 130 PF 5% 300 VDCW	
A5C3	0140-0234	CIFXD MICA 500PF 1% 300VDCW	
A5C4	0140-0195	CIFXD MICA 130 PF 5% 300 VDCW	
A5C5	0140-0234	CIFXD MICA 500PF 1% 300VDCW	
A5C6	0140-0151	CIFXD MICA 820PF 2% 300VDCW	
A5C7	0140-0151	CIFXD MICA 820PF 2% 300VDCW	
A5CR1	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A5CR2	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A5CR3	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A5CR4	1901-0025	DIODE:JUNCTION:5MA AT 1V 100 PIV	
A5L1	9140-0029	COIL:FXD 100 UH 2.6 OHMS	
A5Q1	1854-0003	TRANSISTOR:NPN SILICON	
A5Q2	1854-0003	TRANSISTOR:NPN SILICON	
A5Q3	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A5Q4	1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	
A5Q5	1851-0017	TRANSISTOR:2N1304	
A5R1	0758-0062	RIFXD MET OX 200 OHM 5% 1/2W	
A5R2	0758-0010	RIFXD MET OX FLM 3300 OHM 5% 1/2W	
A5R3	0758-0003	RIFXD MET OX 1000 OHM 5% 1/2W	
A5R4	0758-0064	RIFXD MET OX 36K OHM 5% 1/2W	
A5R5	0758-0010	RIFXD MET OX FLM 3300 OHM 5% 1/2W	
A5R6	0758-0064	RIFXD MET OX 36K OHM 5% 1/2W	
A5R7	0758-0010	RIFXD MET OX FLM 3300 OHM 5% 1/2W	
A5R8	0758-0003	RIFXD MET OX 1000 OHM 5% 1/2W	
A5R9	0758-0062	RIFXD MET OX 200 OHM 5% 1/2W	
A5R10	0758-0062	RIFXD MET OX 200 OHM 5% 1/2W	
A5R11	0758-0062	RIFXD MET OX 200 OHM 5% 1/2W	

✞ = See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	℔ Stock No.	Description #	Note
A5R12	0686-4305	R:FXD COMP 43 OHM 5% 1/2W	
A5R13	0758-0010	R:FXD MET OX FLM 3300 OHM 5% 1/2W	
A5R14	0758-0003	R:FXD MET OX 1000 OHM 5% 1/2W	
A5R15	0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	
A5R16	0683-5105	R:FXD COMP 51 OHM 5% 1/4W	
A6		SAME AS A5, USE PREFIX A6	
A7	05285-6003	BOARD ASSY- DIRECTIONAL CONTROL	
	05285-2003	BOARD- DIRECTIONAL CONTROL(BLANK BOARD)	
A7C1	0140-0190	C:FXD MICA 39 PF 5% 300 VDCW	
A7C2	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A7C3	0140-0203	C:FXD MICA 30PF 5% 500VDCW	
A7C4	0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	
A7C5	0160-0179	C:FXD MICA 33PF 5% 300VDCW	
A7C6	0140-0203	C:FXD MICA 30PF 5% 500VDCW	
A7CR1	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A7CR2	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A7CR3	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A7CR4	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A7CR5	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A7Q1	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7Q2	1853-0009	TRANSISTOR:SILICON PNP	
A7Q3	1853-0009	TRANSISTOR:SILICON PNP	
A7Q4	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7Q5	1853-0009	TRANSISTOR:SILICON PNP	
A7Q6	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7Q7	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7Q8	1853-0009	TRANSISTOR:SILICON PNP	
A7Q9	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7Q10	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7Q11	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A7R1	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7R2	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A7R3	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A7R4	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A7R5	0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	
A7R6	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A7R7	0683-8225	R:FXD COMP 8200 OHM 5% 1/4W	
A7R8	0683-1625	R:FXD COMP 1600 OHM 5% 1/4W	
A7R9	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
A7R10	0683-2735	R:FXD COMP 27K OHM 5% 1/4W	
A7R11	0683-3335	R:FXD COMP 33K OHM 5% 1/4W	
A7R12	0757-0817	R:FXD MET FLM 750 OHM 1% 1/2W	
A7R13	0683-9125	R:FXD COMP 9100 OHM 5% 1/4W	
A7R14	0683-8225	R:FXD COMP 8200 OHM 5% 1/4W	
A7R15	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
A7R16	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R17	0683-3335	R:FXD COMP 33K OHM 5% 1/4W	
A7R18	0757-0198	R:FXD MET FLM 100 OHM 1% 1/2W	
A7R19	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description #	Note
A7R20	0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	
A7R21	0757-0198	R:FXD MET FLM 100 OHM 1% 1/2W	
A7R22	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A7R23	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A7R24	0683-9125	R:FXD COMP 9100 OHM 5% 1/4W	
A7R25	0683-4335	R:FXD COMP 43K OHM 5% 1/4W	
A7R26	0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	
A7R27	0683-3335	R:FXD COMP 33K OHM 5% 1/4W	
A7R28	0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	
A7R29	0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	
A7R30	0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	
A7R31	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A7R32	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A8	05285-6002	BOARD ASSY- PRIORITY	
A8C1	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A8C2	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A8C3	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A8C4	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A8C5	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A8C6	0160-0178	C:FXD MICA 27PF 5% 300VDCW	
A8C7	0160-0178	C:FXD MICA 27PF 5% 300VDCW	
A8C8	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A8C9	0150-0055	C:FXD TI 10 PF 5% 500 VDCW	
A8C10	0150-0055	C:FXD TI 10 PF 5% 500 VDCW	
A8C11	0140-0201	C:FXD MICA 12PF 5% 500VDCW	
A8C12	0140-0201	C:FXD MICA 12PF 5% 500VDCW	
A8CR1	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A8CR2	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A8CR3	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A8CR4	1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60PIV	
A8CR5	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A8CR6	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A8CR7	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A8CR8	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A8Q1	1850-0158	TRANSISTOR:PNP GERMANIUM 2N2635	
A8Q2	1850-0158	TRANSISTOR:PNP GERMANIUM 2N2635	
A8Q3	1850-0158	TRANSISTOR:PNP GERMANIUM 2N2635	
A8Q4	1850-0158	TRANSISTOR:PNP GERMANIUM 2N2635	
A8Q5	1850-0158	TRANSISTOR:PNP GERMANIUM 2N2635	
A8Q6	1850-0158	TRANSISTOR:PNP GERMANIUM 2N2635	
A8Q7	1850-0158	TRANSISTOR:PNP GERMANIUM 2N2635	
A8Q8	1850-0158	TRANSISTOR:PNP GERMANIUM 2N2635	
A8R1	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A8R2	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A8R3	0683-8225	R:FXD COMP 8200 OHM 5% 1/4W	
A8R4	0683-8225	R:FXD COMP 8200 OHM 5% 1/4W	
A8R5	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	
A8R6	0683-1545	R:FXD COMP 150K OHM 5% 1/4W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description #	Note
A8R7	0758-0003	R:FXD MET FLM 1000 OHM 5% 1/2W	
A8R8	0758-0003	R:FXD MET FLM 1000 OHM 5% 1/2W	
A8R9		FACTORY SELECTED PART, TYPICAL VALUE GIVEN	
A8R10	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A8R11		FACTORY SELECTED PART, TYPICAL VALUE GIVEN	
A8R12	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A8R13	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
A8R14	0683-1535	R:FXD COMP 15K OHM 5% 1/4W	
A8R15	0758-0003	R:FXD MET FLM 1000 OHM 5% 1/2W	
A8R16	0758-0003	R:FXD MET FLM 1000 OHM 5% 1/2W	
A8R17	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A8R18	0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	
A8R19	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
A8R20	0683-1235	R:FXD COMP 12K OHM 5% 1/4W	
A8R21		FACTORY SELECTED PART, TYPICAL VALUE GIVEN	
A8R22	0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	
A8R23	0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	
A8R24		FACTORY SELECTED PART, TYPICAL VALUE GIVEN	
A8R25	0683-5625	R:FXD COMP 5600 OHM 5% 1/4W	
A8R26	0683-5625	R:FXD COMP 5600 OHM 5% 1/4W	
A8R27	0758-0070	R:FXD MET FLM 1200 OHM 5% 1/2W	
A8R28	0758-0070	R:FXD MET FLM 1200 OHM 5% 1/2W	
A9	05285-6001	BOARD ASSY.- ANTICOINCIDENCE	
A9C1	0140-0201	C:FXD MICA 12PF 5% 500VDCW	
A9C2	0140-0201	C:FXD MICA 12PF 5% 500VDCW	
A9C3	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A9C4	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A9C5	0140-0200	C:FXD MICA 390PF 5% 300VDCW	
A9C6	0140-0200	C:FXD MICA 390PF 5% 300VDCW	
A9C7	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A9C8	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A9C9	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A9C10	0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	
A9C11	0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	
A9C12	0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	
A9C13	0160-0337	C:FXD MICA 160 PF 1% 300VDCW	
A9C14	0160-0337	C:FXD MICA 160 PF 1% 300VDCW	
A9C15	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A9C16	0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	
A9C17	0140-0207	C:FXD MICA 330PF 5% 500VDCW	
A9C18	0140-0207	C:FXD MICA 330PF 5% 500VDCW	
A9C19	0140-0202	C:FXD MICA 15 PF 5% 500VDCW	
A9C20	0140-0202	C:FXD MICA 15 PF 5% 500VDCW	
A9C21	0140-0202	C:FXD MICA 15 PF 5% 500VDCW	
A9C22	0140-0202	C:FXD MICA 15 PF 5% 500VDCW	
A9C23	0150-0050	C:FXD CER 1000PF 600 VDCW	
A9CR1	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR2	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR3	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR4	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	hp Stock No.	Description #	Note
A9CR5	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR6	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR7	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR8	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR9	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR10	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR11	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A9CR12	1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	
A9CR13	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR14	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR15	1910-0036	DIODE:GERMANIUM 10 MA/1V 8 WIV	
A9CR16	1910-0036	DIODE:GERMANIUM 10 MA/1V 8 WIV	
A9CR17	1910-0036	DIODE:GERMANIUM 10 MA/1V 8 WIV	
A9CR18	1910-0036	DIODE:GERMANIUM 10 MA/1V 8 WIV	
A9CR19	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9CR20	1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	
A9L1	9140-0146	COIL:FXD RF 10.0 UH	
A9L2	9140-0146	COIL:FXD RF 10.0 UH	
A9L3	9140-0105	COIL:FXD RF 8.2 UH	
A9L4	9140-0105	COIL:FXD RF 8.2 UH	
A9L5	9140-0105	COIL:FXD RF 8.2 UH	
A9L6	9140-0105	COIL:FXD RF 8.2 UH	
A9Q1	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q2	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q3	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q4	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q5	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q6	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q7	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q8	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q9	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q10	1850-0158	TRANSISTOR:PNP GERMANIUM 2N2635	
A9Q11	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q12	1850-0158	TRANSISTOR:PNP GERMANIUM 2N2635	
A9Q13	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q14	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q15	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q16	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q17	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9Q18	1854-0005	TRANSISTOR:2N708 NPN SILICON	
A9R1	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
A9R2	0683-1835	R:FXD COMP 18K OHM 5% 1/4W	
A9R3	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A9R4	0683-1045	R:FXD COMP 100K OHM 5% 1/4W	
A9R5	0758-0048	R:FXD MET OX 8200 OHM 5% 1/2W	
A9R6	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A9R7	0758-0048	R:FXD MET OX 8200 OHM 5% 1/2W	
A9R8	0683-1245	R:FXD COMP 120K OHM 5% 1/4W	
A9R9	0758-0043	R:FXD MET OX 1800 OHM 5% 1/2W	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description #	Note
A9R10	0758-0043	R:FXD MET OX 1800 OHM 5% 1/2W	
A9R11	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A9R12	0683-1035	R:FXD COMP 10K OHM 5% 1/4W	
A9R13	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A9R14	0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	
A9R15	0758-0037	R:FXD MET OX 5100 OHM 5% 1/2W	
A9R16	0758-0037	R:FXD MET OX 5100 OHM 5% 1/2W	
A9R17		FACTORY SELECTED VALUE	
A9R18		FACTORY SELECTED VALUE	
A9R19	0758-0031	R:FXD MET OX 680 OHM 5% 1/2W	
A9R20	0758-0031	R:FXD MET OX 680 OHM 5% 1/2W	
A9R21		FACTORY SELECTED VALUE	
A9R22	0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	
A9R23	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A9R24	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A9R25	0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	
A9R26	0683-2715	R:FXD COMP 270 OHM 5% 1/4W	
A9R27	0683-2715	R:FXD COMP 270 OHM 5% 1/4W	
A9R28	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A9R29	0683-6815	R:FXD COMP 680 OHM 5% 1/4W	
A9R30	0683-1515	R:FXD COMP 150 OHM 5% 1/4W	
A9R31	0683-1515	R:FXD COMP 150 OHM 5% 1/4W	
A9R32	0683-8215	R:FXD COMP 820 OHM 5% 1/4W	
A9R33	0683-8215	R:FXD COMP 820 OHM 5% 1/4W	
A9R34	0758-0044	R:FXD MET OX 200 OHM 5% 1/2W	
A9R35	0758-0044	R:FXD MET OX 200 OHM 5% 1/2W	
A9R36	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A9R37	0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	
A9R38	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A9R39	0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	
A9R40	0683-4325	R:FXD COMP 4300 OHM 5% 1/4W	
A9R41	0683-4325	R:FXD COMP 4300 OHM 5% 1/4W	
A9R42	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A9R43	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A9R44	0758-0031	R:FXD MET OX 680 OHM 5% 1/2W	
A9R45	0758-0031	R:FXD MET OX 680 OHM 5% 1/2W	
A9R46	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A9R47	0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	
A9R48	0683-8225	R:FXD COMP 8200 OHM 5% 1/4W	
A9R49	0683-8225	R:FXD COMP 8200 OHM 5% 1/4W	
A9R50	0758-0031	R:FXD MET OX 680 OHM 5% 1/2W	
A9R51	0758-0031	R:FXD MET OX 680 OHM 5% 1/2W	
A9R52	0758-0029	R:FXD MET OX 470 OHM 5% 1/2W	
A9R53	0758-0029	R:FXD MET OX 470 OHM 5% 1/2W	
A9R54	0758-0032	R:FXD MET OX 820 OHM 5% 1/2W	
A9RT1	0839-0029	RESISTOR:TEMPERATURE-SENSITIVE 14K OHM	
A9RT2	0839-0029	RESISTOR:TEMPERATURE-SENSITIVE 14K OHM	
C1	0140-0152	C:FXD MICA 1000 PF 5% 300 VDCW	
C2	0170-0044	C:FXD MY 0.5UF 10% 600VDCW	
C3	0140-0152	C:FXD MICA 1000 PF 5% 300 VDCW	

See list of abbreviations in introduction to this section

Table 6-1. Reference Designation Index (Cont'd)

Reference Designation	Stock No.	Description #	Note
C4	0170-0044	C:FXD MY 0.5UF 10% 600VDCW	
J1	1250-0083	CONNECTOR:BNC	
J2	1250-0083	CONNECTOR:BNC	
		Not Assigned	
		Not Assigned	
MP3	5262A-47A	SPACER-BRACE	
MP4	5262A-47A	SPACER-BRACE	
MP5	5262A-83A	GUIDE- PLUG IN	
MP6	05285-0001	CHASSIS- MAIN	
MP7	05285-0002	SHIELD- INPUT	
MP8	05285-0003	SHIELD- AMP..	
MP9	05285-0004	SIDE FRAME- RIGHT	
MP10	05285-0005	SIDE-FRAME- LEFT	
MP11	05285-0006	PLATE- COVER	
MP12	05285-2004	PANEL- FRONT	
MP13	05285-2005	HOLDER- AMPLIFIER	
P1	1251-0101	CONNECTOR:FEMALE 50-CONTACT	
R1	0686-3325	R:FXD COMP 3300 OHM 5% 1/2W	
R2	0686-3325	R:FXD COMP 3300 OHM 5% 1/2W	
R3	0757-0156	R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	
R4	2100-0366	R:VAR COMP 2.5 MEGOHM 20% LIN 1/4W	
R5	0757-0156	R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	
R6	0757-0156	R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	
R7	2100-0366	R:VAR COMP 2.5 MEGOHM 20% LIN 1/4W	
R8	0757-0156	R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	
S1	3100-1851	SWITCH:ROTARY	
	0370-0077	KNOB:BLK BAR W/ARROW 5/8 IN DIA 1/4 IN SHF	
S2	3100-1852	SWITCH:ROTARY	
	0370-0090	KNOB:BLK W/ARROW 5/8IN. OD 1/4IN. SHAFT	
XA3	1251-0198	CONNECTOR:P C 12 CONTACT	
XA4	1251-0198	CONNECTOR:P C 12 CONTACT	
XA5	1251-0198	CONNECTOR:P C 12 CONTACT	
XA6	1251-0198	CONNECTOR:P C 12 CONTACT	
XA7	1251-0141	CONNECTOR:18-CONTACT	
XA8	1251-0141	CONNECTOR:18-CONTACT	
XA9	1251-0141	CONNECTOR:18-CONTACT	
		MISCELLANEOUS	
	05285-6004	SWITCH ASSY.- FUNCTION	
	8120-0026	CABLE:RF 100 OHM	

See list of abbreviations in introduction to this section

Table 6-2. Replaceable Parts

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
0140-0145	C:FXD MICA 22 PF 5% 500 VDCW	04062	RDM15C220J5C	6
0140-0151	C:FXD MICA 820PF 2% 300VDCW	04062	RDM15F821G3S	8
0140-0152	C:FXD MICA 1000 PF 5% 300 VDCW	04062	DM16F102J	4
0140-0190	C:FXD MICA 39 PF 5% 300 VDCW	04062	RDM15E390J3C	1
0140-0191	C:FXD MICA 56 PF 5% 300 VDCW	04062	RDM15E560J3C	2
0140-0194	C:FXD MICA 110 PF 5% 300 VDCW	04062	RDM15F111J3C	2
0140-0195	C:FXD MICA 130 PF 5% 300 VDCW	04062	RDM15F131J3C	4
0140-0198	C:FXD MICA 200PF 5% 300VDCW	04062	RDM15F201J3C	2
0140-0200	C:FXD MICA 390PF 5% 300VDCW	04062	RDM15F391J3C	2
0140-0201	C:FXD MICA 12PF 5% 500VDCW	04062	RDM15C120J5C	4
0140-0202	C:FXD MICA 15 PF 5% 500VDCW	28480	0140-0202	4
0140-0203	C:FXD MICA 30PF 5% 500VDCW	04062	DM15E300J 500V	2
0140-0204	C:FXD MICA 47PF 5% NPO 500VDCW	04062	RDM15E470J5C	3
0140-0207	C:FXD MICA 330PF 5% 500VDCW	04062	RDM15F331J5C	2
0140-0221	C:FXD MICA 220PF 1% 300VDCW	04062	RDM15F221F3C	4
0140-0225	C:FXD MICA 300PF 1% 300VDCW	04062	RDM15F301F3C	2
0140-0234	C:FXD MICA 500PF 1% 300VDCW	04062	RDM15F501F3C	4
0150-0045	C:FXD TI 8.2 PF 5% 500 VDCW	78488	TYPE GA	2
0150-0050	C:FXD CER 1000PF 600 VDCW	84411	TYPE E	1
0150-0055	C:FXD TI 10 PF 5% 500 VDCW	78488	TYPE GA	2
0150-0121	C:FXD CER 0.1UF +80%-20% 50VDCW	56289	5C50A	9
0160-0127	C:FXD CER 1UF 20% 25VDCW	56289	5C13	2
0160-0178	C:FXD MICA 27PF 5% 300VDCW	04062	RDM15E270J3S	2
0160-0179	C:FXD MICA 33PF 5% 300VDCW	04062	RDM15E330J3S	1
0160-0196	C:FXD MICA 24PF 5% 300VDCW	04062	RDM15C240J3S	2
0160-0337	C:FXD MICA 160 PF 1% 300VDCW	04062	RDM15F161F3C	2
0170-0044	C:FXD MY 0.5UF 10% 600VDCW	09134	TYPE 27	2
0180-0116	C:FXD ELECT TA 6.8 UF 10% 35VDCW	56289	150D685X9035B2	2
0370-0077	KNOB:BLK BAR W/ARROW 5/8 IN DIA 1/4 IN SHF	28480	0370-0077	1
0370-0090	KNOB:BLK W/ARROW 5/8IN. OD 1/4IN. SHAFT	28480	5040-0105	1
0370-0100	KNOB:RED W/ARROW 1/2IN. OD 3/16 IN.SHAFT	28480	0370-0100	4
0370-0101	KNOB:BLK CONCENTRIC 5/8IN. OD 1/4IN. SHAFT	28480	0370-0101	4
0683-0275	R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5	2
0683-1035	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035	4
0683-1045	R:FXD COMP 100K OHM 5% 1/4W	01121	CB 1045	2
0683-1235	R:FXD COMP 12K OHM 5% 1/4W	01121	CB 1235	2
0683-1245	R:FXD COMP 120K OHM 5% 1/4W	01121	CB 1245	2
0683-1325	R:FXD COMP 1300 OHM 5% 1/4W	01121	CB 1325	4
0683-1515	R:FXD COMP 150 OHM 5% 1/4W	01121	CB 1515	2
0683-1525	R:FXD COMP 1500 OHM 5% 1/4W	01121	CB 1525	4
0683-1535	R:FXD COMP 15K OHM 5% 1/4W	01121	CB 1535	4
0683-1545	R:FXD COMP 150K OHM 5% 1/4W	01121	CB 1545	2
0683-1625	R:FXD COMP 1600 OHM 5% 1/4W	01121	CB 1625	1
0683-1825	R:FXD COMP 1800 OHM 5% 1/4W	01121	CB 1825	1
0683-1835	R:FXD COMP 18K OHM 5% 1/4W	01121	CB 1835	2
0683-2225	R:FXD COMP 2.2K OHM 5% 1/4W	01121	GB 2225	6
0683-2715	R:FXD COMP 270 OHM 5% 1/4W	01121	CB 2715	2
0683-2735	R:FXD COMP 27K OHM 5% 1/4W	01121	CB 2735	1

See list of abbreviations in introduction to this section

Table 6-2. Replaceable Parts (Cont'd)

Stock No.	Description #	Mfr.	Mfr. Part No.	TQ
0683-3025	R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025	2
0683-3325	R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325	2
0683-3335	R:FXD COMP 33K OHM 5% 1/4W	01121	CB 3335	3
0683-3925	R:FXD COMP 3900 OHM 5% 1/4W	01121	CB 3925	4
0683-4325	R:FXD COMP 4300 OHM 5% 1/4W	01121	CB 4325	2
0683-4335	R:FXD COMP 43K OHM 5% 1/4W	01121	CB 4335	1
0683-4725	R:FXD COMP 4700 OHM 5% 1/4W	01121	CB 4725	4
0683-5105	R:FXD COMP 51 OHM 5% 1/4W	01121	CB 5105	2
0683-5125	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125	2
0683-5625	R:FXD COMP 5600 OHM 5% 1/4W	01121	CB 5625	2
0683-6815	R:FXD COMP 680 OHM 5% 1/4W	01121	CB 6815	4
0683-6825	R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825	2
0683-7525	R:FXD COMP 7500 OHM 5% 1/4W	01121	CB 7525	4
0683-8215	R:FXD COMP 820 OHM 5% 1/4W	01121	CB 8215	2
0683-8225	R:FXD COMP 8200 OHM 5% 1/4W	01121	CB 8225	6
0683-9125	R:FXD COMP 9100 OHM 5% 1/4W	01121	CB 9125	2
0686-1055	R:FXD COMP 1 MEGOHM 5% 1/2W	01121	EB 1055	2
0686-1155	R:FXD COMP 1.1 MEGOHM 5% 1/2W	01121	EB 1155	2
0686-3325	R:FXD COMP 3300 OHM 5% 1/2W	01121	EB 3325	2
0686-4305	R:FXD COMP 43 OHM 5% 1/2W	01121	EB 4305	2
0757-0156	R:FXD MET FLM 1.5 MEGOHM 1% 1/2W	28480	0757-0156	4
0757-0198	R:FXD MET FLM 100 OHM 1% 1/2W	28480	0757-0198	2
0757-0270	R:FXD MET FLM 249K OHM 1% 1/8W	28480	0757-0270	2
0757-0817	R:FXD MET FLM 750 OHM 1% 1/2W	28480	0757-0817	1
0758-0003	R:FXD MET OX 1000 OHM 5% 1/2W	28480	0758-0003	10
0758-0005	R:FXD MET OX 4700 OHM 5% 1/2W	28480	0758-0005	2
0758-0006	R:FXD MET OX 10K OHM 5% 1/2W	28480	0758-0006	2
0758-0010	R:FXD MET OX FLM 3300 OHM 5% 1/2W	28480	0758-0010	8
0758-0013	R:FXD MET OX 120 OHM 5% 1/2W	28480	0758-0013	4
0758-0018	R:FXD MET OX 15K OHM 5% 1/2W	28480	0758-0018	4
0758-0021	R:FXD MET OX 51K OHM 5% 1/2W	28480	0758-0021	2
0758-0029	R:FXD MET OX 470 OHM 5% 1/2W	28480	0758-0029	2
0758-0031	R:FXD MET OX 680 OHM 5% 1/2W	28480	0758-0031	18
0758-0032	R:FXD MET OX 820 OHM 5% 1/2W	28480	0758-0032	1
0758-0033	R:FXD MET OX 2000 OHM 5% 1/2W	28480	0758-0033	2
0758-0037	R:FXD MET OX 5100 OHM 5% 1/2W	28480	0758-0037	4
0758-0042	R:FXD MET OX 1300 OHM 5% 1/2W	28480	0758-0042	2
0758-0043	R:FXD MET OX 1800 OHM 5% 1/2W	28480	0758-0043	4
0758-0044	R:FXD MET OX 200 OHM 5% 1/2W	28480	0758-0044	2
0758-0045	R:FXD MET OX 3900 OHM 5% 1/2W	28480	0758-0045	10
0758-0048	R:FXD MET OX 8200 OHM 5% 1/2W	28480	0758-0048	2
0758-0059	R:FXD MET OX 11K OHM 5% 1/2W	28480	0758-0059	2
0758-0060	R:FXD MET OX 110K OHM 5% 1/2W	28480	0758-0060	2
0758-0061	R:FXD MET OX 120K OHM 5% 1/2W	28480	0758-0061	2
0758-0062	R:FXD MET OX 200 OHM 5% 1/2W	28480	0758-0062	8
0758-0063	R:FXD MET OX 1600 OHM 5% 1/2W	28480	0758-0063	2
0758-0064	R:FXD MET OX 36K OHM 5% 1/2W	28480	0758-0064	4
0758-0070	R:FXD MET OX 1200 OHM 5% 1/2W	28480	0758-0070	4
0758-0073	R:FXD MET OX 24K OHM 5% 1/2W	28480	0758-0073	2
0758-0074	R:FXD MET OX 27K OHM 5% 1/2W	28480	0758-0074	2
0758-0100	R:FXD MET OX 330K OHM 5% 1/2W	28480	0758-0100	2

See list of abbreviations in introduction to this section

Table 6-2. Replaceable Parts (Cont'd)

hp Stock No.	Description #	Mfr.	Mfr. Part No.	TQ	RS
0839-0029	RESISTOR:TEMPERATURE-SENSITIVE 14K OHM	17109	M709-113	2	2
1250-0083	CONNECTOR:BNC	28480	1250-0083	2	1
1251-0101	CONNECTOR:FEMALE 50-CONTACT	28480	1251-0101	1	1
1251-0141	CONNECTOR:18-CONTACT	28480	1251-0141	3	1
1251-0198	CONNECTOR:P C 12 CONTACT	28480	1251-0198	4	1
1850-0091	TRANSISTOR:GERMANIUM 2N2048 PNP	87216	2N2048	4	4
1850-0158	TRANSISTOR:PNP GERMANIUM 2N2635	01295	2N2635	10	10
1851-0017	TRANSISTOR:2N1304	01295	2N1304	4	4
1853-0003	TRANSISTOR:PNP SILICON F 50MC MIN	28480	1853-0003	4	4
1853-0009	TRANSISTOR:SILICON PNP	28480	1853-0009	4	4
1854-0003	TRANSISTOR:NPN SILICON	28480	1854-0003	8	8
1854-0005	TRANSISTOR:2N708 NPN SILICON	07263	2N708	23	13
1854-0014	TRANSISTOR:DUAL NPN SILICON	28480	1854-0014	2	2
1901-0025	DIODE:JUNCTION:5MA AT 1V 100 PIV	28480	1901-0025	2	2
1901-0040	DIODE:SILICON 30 MA AT 1V 30 PIV	28480	1901-0040	23	13
1902-0048	SEMICON DEVICE:DIODE BREAKDOWN	28480	1902-0048	2	2
1910-0016	DIODE:GERMANIUM 100MA AT 0.85V 60P1V	28480	1910-0016	12	11
1910-0022	SEMICON DEVICE:DIODE GE 100MA 6PIV 3.5NS	28480	1910-0022	4	4
1910-0036	DIODE:GERMANIUM 10 MA/1V 8 WIV	28480	1910-0036	4	4
2100-0366	R:VAR COMP 2.5 MEGOHM 20% LIN 1/4W	28480	2100-0366	2	1
3100-0367	SWITCH:ROTARY 3 SECT 6 POS	28480	3100-0367	2	1
3100-1851	SWITCH:ROTARY	28480	3100-1851	1	1
3100-1852	SWITCH:ROTARY	28480	3100-1852	1	1
8120-0026	CABLE:RF 100 OHM	28480	8120-0026	1	
9140-0029	COIL:FXD 100 UH 2.6 OHMS	99848	310015101	2	1
9140-0105	COIL:FXD RF 8.2 UH	28480	9140-0105	4	1
9140-0146	COIL:FXD RF 10.0 UH	99800	1025-44	2	1
05285-0001	CHASSIS- MAIN	28480	05285-0001	1	
05285-0002	SHIELD- INPUT	28480	05285-0002	1	
05285-0003	SHIELD- AMP.	28480	05285-0003	1	
05285-0004	SIDE FRAME- RIGHT	28480	05285-0004	1	
05285-0005	SIDE-FRAME- LEFT	28480	05285-0005	1	
05285-0006	PLATE- COVER	28480	05285-0006	1	
05285-2003	BOARD- DIRECTIONAL CONTROL(BLANK BOARD)	28480	05285-2003	1	
05285-2004	PANEL- FRONT	28480	05285-2004	1	
05285-2005	HOLDER- AMPLIFIER	28480	05285-2005	1	
05285-6001	BOARD ASSY.- ANTICOINCIDENCE	28480	05285-6001	1	
05285-6002	BOARD ASSY- PRIORITY	28480	05285-6002	1	
05285-6003	BOARD ASSY- DIRECTIONAL CONTROL	28480	05285-6003	1	
05285-6004	SWITCH ASSY.- FUNCTION	28480	05285-6004	1	
5233L-65E-1	BOARD- AMPLIFIER(BLANK BOARD)	28480	5233L-65E-1	2	
5233L-65F-1	BOARD- TRIGGER(BLANK BOARD)	28480	5233L-65F-1	2	
5233L-198	SWITCH ASS'Y.- ATTEN.	28480	5233L-198	1	
5233L-65E	AMPLIFIER ASSY.	28480	5233L-65E	2	
5233L-65F	TRIGGER ASS'Y.	28480	5233L-65F	2	
5262A-47A	SPACER-BRACE	28480	5262A-47A	2	
5262A-83A	GUIDE- PLUG IN	28480	5262A-83A	1	

See list of abbreviations in introduction to this section

Table 6-3. Code List of Manufacturers

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

Code No.	Manufacturer	Address
00000	U. S. A. Common	Any supplier of U.S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N.Y.
00787	Cemco inc	Danielson, Conn.
00334	Humidial	Colton, Calif.
00346	Microlton Co., Inc.	Valley Stream, N.Y.
00373	Garlock inc	Cherry Hill, N.J.
00656	Aerovox Corp	New Bedford, Mass
00779	Amp Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N.J.
00[illegible]	Croven Ltd.	Whitby Ontario Canada
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Co. Pickens Div	Pickens, S.C.
00866	Goe Engineering Co	City of Industry, Cal.
00891	Carl E. Holmes Corp.	Los Angeles, Calif
00929	Microlab Inc.	Livingston, N.J
01002	General Electric Co., Capacitor Dept	Hudson Falls, N.Y.
01009	Alden Products Co	Brockton, Mass.
01121	Allen Bradley Co	Milwaukee, Wis
01255	Litton Industries, Inc	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc	Lawndale, Calif
01295	Texas Instruments, Inc., Transistor Products Div	Dallas Texas
01349	The Alliance Mfg Co	Alliance, Ohio
01355	Small Parts Inc	Los Angeles Calif
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01620	Gudebrod Bros. Silk Co.	New York, N.Y.
01930	Amerock Corp.	Rockford, Ill
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02116	Wheelock Signals, Inc.	Long Branch, N.J.
02286	Cole Rubber and Plastics Inc.	Sunnyvale, Calif
02660	Amphenol-Borg Electronics Corp	Broadview, Ill.
02735	Radio Corp of America, Semiconductor and Materials Div	Somerville, N.J.
02777	Vocaline Co of America Inc.	Old Saybrook, Conn.
02817	Hopkins Engineering Co.	San Fernando, Calif.
02866	Hudson Tool & Die Co	Newark, N.J.
03508	G E Semiconductor Prod Dept.	Syracuse, N.Y.
03606	Apex Machine & Tool Co	Dayton Ohio
03797	Eldema Corp.	Compton, Calif
03815	Parker Seal Co	Los Angeles Calif
03867	Transitron Electric Corp	Wakefield, Mass
03888	Pyrofilm Resistor Co Inc.	Cedar Knolls, N.J.
03954	Singer Co., Diehl Div Finderne Plant	Somerville, N.J.
04009	Arrow Hart and Hegeman Elect Co.	Hartford, Conn
04041	Taurus Corp	Lambertville, N.J.
04062	Arco Electronic Inc	Great Neck, N.Y
04213	Essex Wire	Los Angeles Calif
04272	Hi Q Division of Aerovox	Myrtle Beach, S.C
04354	Precision Paper Tube Co.	Wheeling, Ill
04404	Dymec Division of Hewlett-Packard Co	Palo Alto, Calif
04651	Sylvania Electric Products, Microwave Device Div	Mountain View, Calif
04713	Dakota Engr inc.	Culver City, Calif
04713	Motorola Inc., Semiconductor Prod Div	Phoenix, Arizona
04732	Fulton Co., Inc. Western Div	Culver City, Calif
04773	Automatic Electric Co	Northlake, Ill
04796	Sequoia Wire Co	Redwood City, Calif
04811	Precision Coil Spring Co	El Monte Calif
04906	P M Motor Company	Westchester, Ill
04919	Component Mfg Service Co	W Bridgewater Mass
05006	Twentieth Century Plastics, Inc	Los Angeles, Calif
05245	Components Corp	Chicago, Ill.
05277	Westinghouse Electric Corp. Semi-Conductor Dept	Youngwood, Pa.
05347	Ultronix, Inc	San Mateo, Calif
05397	Union Carbide Corp., Elect. Div.	New York, N.Y.
05574	Viking Ind Inc	Canoga Park, Calif.
05593	Icore Electro-Plastics Inc.	Sunnyvale, Calif.
05616	Cosmo Plastic (c o Electrical Spec Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Ill
05728	Tiffen Optical Co	Roslyn Heights, Long Island, N.Y
05729	Metro-Tel Corp	Westbury, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	Bassick Co., Div of Stewart Warner Corp	Bridgeport, Conn
06090	Raychem Corp.	Redwood City, Calif.
06175	Bausch and Lomb Optical Co	Rochester, N.Y.
06407	E. T. A. Products Co. of America	Chicago, Ill
06540	Amatom Electronic Hardware Co., Inc	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H
06666	General Devices Co., Inc	Indianapolis, Ind
06751	Components Inc., Ariz. Div.	Phoenix, Ariz.
06812	Torrington Mfg Co., West Div	Van Nuys, Calif
06980	Varian Assoc. Eimac Div	San Carlos, Calif.
07088	Kelvin Electric Co.	Van Nuys, Calif
07126	Digitran Co	Pasadena, Calif
07137	Transistor Electronics Corp	Minneapolis, Minn
07138	Westinghouse Electric Corp Electronic Tube Div.	Elmira, N.Y
07149	Filmohm Corp.	New York, N.Y
07233	Cinch Graphik Co	City of Industry Calif.
07256	Silicon Transistor Corp	Carle Place, N.Y
07261	Avnel Corp	Culver City, Calif
07263	Fairchild Camera & Inst Corp Semiconductor Div	Mountain View, Calif
07322	Minnesota Rubber Co	Minneapolis, Minn
07387	Bittcher Corp., The	Monterey Park, Calif
07397	Sylvania Elect Prod. Inc., Mt. View Operations	Mountain View, Calif
07700	Technical Wire Products Inc	Cranford, N.J
07829	Bodine Elect Co	Chicago, Ill
07910	Continental Device Corp	Hawthorne, Calif
07933	Raytheon Mfg Co Semiconductor Div	Mountain View, Calif
07980	Hewlett-Packard Co., Boonton Radio Div	Rockaway, N.J
08145	U S Engineering Co	Los Angeles, Calif
08289	Blinn, Delbert Co	Pomona, Calif
08358	Burgess Battery Co	Niagara Falls, Ontario Canada
08574	Deutsch Fastener Corp.	Los Angeles, Calif
08664	Bristol Co., The	Waterbury, Conn
08717	Sloan Company	Sun Valley, Calif
08718	ITT Cannon Electric Inc., Phoenix Div	Phoenix, Arizona
08727	National Radio Lab Inc.	Paramus, N.J
08792	CBS Electronics Semiconductor Operations Div of C B S Inc	Lowell, Mass
08806	General Electric Co. Miniat Lamp Dept	Cleveland, Ohio
08984	Met-Ram	Indianapolis, Ind
09026	Babcock Relays Div	Costa Mesa, Calif
09134	Texas Capacitor Co	Houston, Texas
09145	Tech Ind Inc Atohm Elect	Burbank, Calif
09250	Electro Assemblies, Inc	Chicago, Ill
09353	C & K Components Inc.	Newton, Mass.
09569	Mallory Battery Co of Canada, Ltd.	Toronto, Ontario, Canada
09922	Burndy Corp.	Norwalk, Conn.
10214	General Transistor Western Corp	Los Angeles, Calif
10411	Tr Tal, Inc	Berkeley, Calif.
10646	Carborundum Co.	Niagara Falls, N.Y
11236	CTS of Berne, Inc	Berne, Ind
11237	Chicago Telephone of California, Inc	So Pasadena, Calif
11242	Bay State Electronics Corp.	Waltham, Mass
11312	Teledyne Inc., Microwave Div	Palo Alto, Calif.
11314	National Seal	Downey, Calif.
11453	Precision Connector Corp.	Jamaica, N.Y.
11534	Duncan Electronics Inc	Costa Mesa, Calif
11711	General Instrument Corp., Semiconductor Div., Products Group	Newark, N.J
11717	Imperial Electronic, Inc	Buena Park, Calif
11870	Melabs, Inc	Palo Alto, Calif
12040	National Semiconductor	Danbury Conn
12136	Philadelphia Handle Co	Camden, N.J
12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
12574	Gulton Ind Inc Data System Div	Albuquerque N.M
12697	Clarostat Mfg Co	Dover, N.H
12728	Elmar Filter Corp	W Haven, Conn
12859	Nippon Electric Co., Ltd	Tokyo, Japan
12881	Metex Electronics Corp	Clark, N.J
12930	Delta Sem conductor Inc	Newport Beach, Calif
12954	Dickson Electronics Corp	Scottsdale, Arizona
13050	Anco Supply Co., Inc	Wichita, Kansas
13103	Thermoloy	Dallas, Texas
13396	Telefunken (GmbH)	Hanover, Germany
13815	Midland Wright Div of Pacific Industries, Inc	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Calif
14193	Calif Resistor Corp	Santa Monica, Calif.
14298	American Components, Inc	Conshohocken, Pa
14433	ITT Semiconductor, A Div of Int Telephone & Telegraph Corp	West Palm Beach, Fla
14433	Hewlett Packard Company	Loveland, Colo
14655	Cornell Dubilier Electric Corp	Newark, N.J.
14674	Corning Glass Works	Corning, N.Y
14752	Electro Cube Inc	San Gabriel Calif
14936	Williams Mfg. Co	San Jose, Calif
15040	The Sphere Co., Inc	Little Falls N.J
15205	Webster Electronics Co	New York, N.Y
15287	Scionics Corp.	Northridge, Calif.
15291	Adjustable Bushing Co	N Hollywood, Calif
15538	Micron Electronics	Garden City, Long Island, N.Y
15566	Amprobe Inst Corp	Lynbrook, N.Y
15631	Cabletronics	Costa Mesa, Calif
15772	Twentieth Century Coil Spring Co	Santa Clara Calif
15801	Fenwal Elect Inc.	Framingham, Mass
15818	Amelco Inc.	Mt View, Calif
16037	Spruce Pine Mica Co	Spruce Pine, N.C
16179	Omni-Spectra Inc	Farmington, Mich
16352	Computer Diode Corp	Lodi, N.J
16530	Bools Aircraft Nut Corp	Pasadena, Calif
16688	Ideal Prec Meter Co., Inc De Jur Meter Div	Brooklyn, N.Y
16758	Delco Radio Div of G M Corp	Kokomo, Ind
17209	Thermonetics Inc	Canoga Park, Calif
17474	Tranes Company	Mountain View, Calif
17554	Components Inc	Biddeford Me
17615	Hamlin Metal Products Corp.	Akron Ohio
17645	Angstrohm Prec Inc	No Hollywood, Calif
[illegible]	nix Inc	Sunnyvale Calif

Table 6-3. Code List of Manufacturers (Cont'd)

Code No.	Manufacturer	Address
[illegible]	McGraw-Edison Co.	Manchester, N H.
18612	Power Design Pacific Inc.	Palo Alto, Calif.
[illegible]	Clevite Corp , Semiconductor Div	Palo Alto, Calif.
18324	Signetics Corp	Sunnyvale, Calif.
18476	Ty Car Mfg Co , Inc	Hollister, Mass.
18486	TRW Elect Comp Div	Des Plaines, Ill
18583	Curtis Instrument, Inc.	Mt Kisco, N.Y
18612	Vishay Instruments Inc.	Malvern, Pa.
18854	E I DuPont and Co., Inc.	Wilmington, Del
18911	Durant Mfg. Co.	Milwaukee, Wis.
19315	The Bendix Corp , Navigation & Control Div	Teterboro, N J.
19500	Thomas A Edison Industries Div. of McGraw-Edison Co	West Orange, N.J.
19589	Concoa	Baldwin Park, Calif.
19644	LRC Electronics	Horseheads, N.Y.
19701	Electra Mfg Co	Independence, Kansas
20982	General Atronics Corp	Philadelphia, Pa.
21226	Executone, Inc	Long Island City, N Y.
21845	Fafnir Bearing Co , The	New Britain, Conn.
21947	Fansteel Metallurgical Corp.	N Chicago, Ill.
23331	Texscan Corp.	Indianapolis, Ind
23883	British Radio Electronics Ltd	Washington, D.C.
24455	G.E Lamp Division	Nela Park, Cleveland, Ohio
24655	General Radio Co	West Concord, Mass
24681	Memcor Inc , Comp Div.	Huntington, Ind.
24931	Pareico Inc	San Juan Capistrano, Calif
25305	Gries Reproducer Corp	New Rochelle, N.Y
26462	Grobet File Co of America, Inc	Carlstadt, N J
26655	Compac Hollister Co	Hollister, Calif.
26992	Hamilton Watch Co	Lancaster, Pa
27251	Specialties Mfg Co , Inc	Stratford, Conn
28480	Hewlett Packard Co	Palo Alto, Calif
28980	Heyman Mfg Co	Kenilworth, N.J.
30817	Instrument Specialties Co , Inc	Little Falls, N.J.
[illegible]	G E Receiving Tube Dept.	Owensboro, Ky
35434	Lectrohm Inc	Chicago, Ill.
36196	Stanwyck Coil Products Ltd	Hawkesbury, Ontario, Canada
36857	Cunningham, W.H. & Hill, Ltd	Toronto Ontario, Canada
37942	P R Mallory & Co Inc	Indianapolis, Ind
38545	Mechanical Industries Prod Co.	Akron, Ohio
40310	Miniature Precision Bearings, Inc	Keene, N H.
42190	Muter Co.	Chicago, Ill
43508	C A Norgren Co	Englewood, Colo
44655	Ohmite Mfg Co	Skokie, Ill
46384	Penn Eng & Mfg Corp.	Doylestown, Pa
47904	Polarad Corp	Cambridge Mass
48620	Precision Thermometer & Inst Co	Southampton, Pa
49956	Microwave & Power Tube Div	Waltham, Mass
52040	Rowan Controller Co.	Westminster Md
53983	Sanborn Company	Waltham, Mass
54294	Shallcross Mfg Co	Selma, N.C
55026	Simpson Electric Co	Chicago, Ill
55333	Sonotone Corp	Elmsford, N.Y.
55938	Raytheon Co Commercial Apparatus & Systems Div	So Norwalk, Conn
56501	Spaulding Fibre Co Inc	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams Mass
59446	Telex Corp	Tulsa, Okla
59730	Thomas & Betts Co	Elizabeth, N J
60741	Triplett Electrical Inst Co	Bluffton, Ohio
61935	Union Switch and Signal, Div of Westinghouse Air Brake Co	Pittsburgh, Pa
62119	Universal Electric Co	Owosso, Mich
63743	Ward-Leonard Electric Co	Mt Vernon, N.Y.
64959	Western Electric Co , Inc	New York, N.Y
65092	Weston Inst Inc Weston Newark	Newark, N.J.
66295	Wiltek Mfg Co.	Chicago, Ill.
66346	Minnesota Mining & Mfg Co Revere Mincom Div	St Paul Minn
70276	Allen Mfg. Co	Hartford, Conn
70309	Allied Control	New York, N.Y.
70318	Allmetal Screw Product Co , Inc	Garden City, N.Y
70417	Amplex, Div. of Chrysler Corp.	Detroit, Mich.
70485	Atlantic India Rubber Works, Inc	Chicago, Ill.
70563	Amperite Co., Inc.	Union City, N J.
70674	ADC Products Inc.	Minneapolis, Minn
70903	Belden Mfg Co.	Chicago, Ill.
70998	Bird Electronic Corp	Cleveland, Ohio
71002	Birnbach Radio Co	New York, N.Y.
71034	Bliley Electric Co., Inc.	Erie, Pa.
71041	Boston Gear Works Div of Murray Co of Texas	Quincy, Mass.
71218	Bud Radio, Inc.	Willoughby, Ohio
71279	Cambridge Thermionics Corp.	Cambridge, Mass.
71286	Camloc Fastener Corp	Paramus, N.J
71313	Cardwell Condenser Corp	Lindenhurst L.I , N.Y
71400	Bussmann Mfg Div of McGraw-Edison Co	St Louis, Mo.
71436	Chicago Condenser Corp	Chicago, Ill
71447	Calif Spring Co , Inc.	Pico-Rivera, Calif.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric Inc.	Los Angeles, Calif.
71471	Cinema, Div. Aerovox Corp.	Burbank, Calif.
71482	C P. Clare & Co.	Chicago, Ill
71590	Centralab Div of Globe Union Inc	Milwaukee, Wis
71616	Commercial Plastics Co	Chicago, Ill
71700	Cornish Wire Co , The	New York, N.Y.
71707	Coto Coil Co , Inc.	Providence, R.I
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co., Howard B. Jones Div	Chicago, Ill.
71984	Dow Corning Corp.	Midland Mich
72136	Electro Motive Mfg Co , Inc.	Willimantic, Conn
72619	Dialight Corp.	Brooklyn, N.Y
72656	Indiana General Corp , Electronics Div	Keasby, N J
72699	General Instrument Corp Cap. Div. Newark, N.J.	
72765	Drake Mfg Co.	Harwood Heights, Ill.
72825	Hugh H Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co	Chicago, Ill
72962	Elastic Stop Nut Corp	Union, N.J.
72964	Robert M. Hadley Co	Los Angeles, Calif
72982	Erie Technological Products, Inc	Erie, Pa
73061	Hansen Mfg. Co , Inc	Princeton, Ind
73076	H M Harper Co	Chicago Ill
73138	Heilpot Div of Beckman Inst , Inc	Fullerton Calif
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif
73445	Amperex Elect Co.	Hicksville, L.I , N Y
73506	Bradley Semiconductor Corp.	New Haven, Conn
73559	Carling Electric, Inc	Hartford, Conn
73586	Circle F Mfg Co	Trenton, N J
73682	George K Garrett Co , Div MSL Industries Inc	Philadelphia Pa
73734	Federal Screw Products Inc	Chicago, Ill
73742	Fischer Special Mfg Co	Cincinnati Ohio
73809	General Industries Co The	Elyria Ohio
73846	Goshen Stamping & Tool Co	Goshen, Ind
73899	JFD Electronics Corp	Brooklyn N Y
73905	Jennings Radio Mfg Corp	San Jose Calif.
73957	Groov-Pin Corp	Ridgefield, N J.
74276	Signalite Inc	Neptune, N J
74455	J H Winns and Sons	Winchester, Mass
74861	Industrial Condenser Corp	Chicago, Ill
74868	R F Products Division of Amphenol-Borg Electronics Corp	Danbury Conn
74970	E.F Johnson Co	Waseca, Minn
75042	International Resistance Co	Philadelphia, Pa
75263	Keystone Carbon Co , Inc	St Marys, Pa.
75378	CTS Knights Inc.	Sandwich, Ill.
75382	Kulka Electric Corporation	Mt Vernon, N Y.
75818	Lenz Electric Mfg Co	Chicago, Ill.
75915	Littlefuse, Inc	Des Plaines, Ill.
76005	Lord Mfg Co	Erie, Pa.
76210	C W Marwedel	San Francisco, Calif
76433	General Instrument Corp , Micamold Division	Newark, N J
76487	James Millen Mfg Co., Inc.	Malden, Mass
76493	J.W Miller Co.	Los Angeles, Calif
76530	Cinch Monadnock, Div. of United Carr Fastener Corp	San Leandro, Calif.
76545	Mueller Electric Co	Cleveland, Ohio
76703	National Union	Newark, N J
76854	Oak Manufacturing Co.	Crystal Lake, Ill
77068	The Bendix Corp , Electrodynamics Div	N Hollywood, Calif
77075	Pacific Metals Co	San Francisco Calif
77221	Phanostran Instrument and Electronic Co.	South Pasadena, Calif
77252	Philadelphia Steel and Wire Corp	Philadelphia, Pa.
77342	American Machine & Foundry Co Potter & Brumfield Div	Princeton, Ind
77630	TRW Electronic Components Div.	Camden, N J
77638	General Instrument Corp , Rectifier Div	Brooklyn N Y
77764	Resistance Products Co	Harrisburg, Pa.
77969	Rubbercraft Corp of Calif	Torrance, Calif
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78277	Sigma	So Braintree Mass.
78283	Signal Indicator Corp	New York, N.Y.
78290	Struthers-Dunn Inc.	Pitman, N J
78424	Specialty Leather Prod Co	Newark, N.J.
78452	Thompson-Bremer & Co	Chicago, Ill.
78488	Tilley Mfg Co.	San Francisco, Calif.
78493	Stackpole Carbon Co.	St Marys, Pa
78590	Standard Thomson Corp	Waltham, Mass
78633	Tinnerman Products, Inc	Cleveland, Ohio
78790	Transformer Engineers	San Gabriel, Calif
78947	Ucinite Co	Newtonville Mass
79136	Waldes Kohinoor Inc.	Long Island City, N Y
79142	Veeder Root, Inc	Hartford, Conn
79255	Wenco Mfg Co.	Chicago Ill
79727	Continental Wirt Electronics Corp	Philadelphia Pa
79963	Zierick Mfg Corp	New Rochelle, N Y
80031	Mepco Division of Sessions Clock Co	Morristown N J
[illegible]	Prestole Corp	Toledo Ohio
80120	Schnitzer Alloy Products Co.	Elizabeth, N J.
80610	Electronic Industries Association Any brand Tube meeting EIA Standards Washington, DC	
80207	Unimax Switch Div Maxon Electronics Corp	Wallingford Conn
80223	United Transformer Corp	New York, N Y
80246	Oxford Electric Corp	Chicago Ill
80294	Bourns Inc	Riverside, Calif
80411	Acro Div of Robertshaw Controls Co	Columbus Ohio

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Table 6-3. Code List of Manufacturers (Cont'd)

Code No	Manufacturer	Address
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Label Co	Monrovia, Calif.
80580	Hammarlund Co., Inc	Mars Hill, N.C.
80640	Stevens, Arnold, Co., Inc	Boston Mass
80813	Dimco Gray Co	Dayton, Ohio
81030	International Instruments Inc	Orange, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Calif.
81312	Winchester Elec Div. Litton Ind., Inc	Oakville, Conn.
81349	Military Specification	
81483	International Rectifier Corp	El Segundo, Calif.
81541	Airpax Electronics, Inc.	Cambridge, Maryland
81860	Barry Controls, Div Barry Wright Corp	Watertown, Mass.
82042	Carter Precision Electric Co.	Skokie, Ill.
82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	Hoboken, N.J.
82116	Electric Regulator Corp.	Norwalk, Conn.
82142	Jeffers Electronics Division of Speer Carbon Co	Du Bois, Pa
82170	Fairchild Camera & Inst Corp Space & Defense System Div	Paramus, N.J.
82209	Maguire Industries, Inc	Greenwich, Conn.
82219	Sylvania Electric Prod Inc Electronic Tube Division	Emporium, Pa.
82376	Astron Corp	East Newark, Harrison, N.J.
82389	Switchcraft, Inc	Chicago, Ill.
82647	Metals & Controls Inc Spencer Products	Attleboro, Mass
82768	Phillips-Advance Control Co.	Joliet, Ill.
82866	Research Products Corp	Madison, Wis
82877	Rotron Mfg Co., Inc	Woodstock, N.Y.
82893	Vector Electronic Co	Glendale, Calif.
83014	Hartwell Corp	Los Angeles, Calif
83058	Carr Fastener Co	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc	Peterborough, N.H.
83125	General Instrument Corp., Capacitor Div	Darlington, S.C.
83148	ITT Wire and Cable Div	Los Angeles, Calif.
83186	Victory Eng Corp.	Springfield, N.J.
83298	Bendix Corp Red Bank Div	Red Bank, N.J.
83385	Hubbell Corp	Mundelein, Ill.
83574	Rosan Inc	Newport Beach, Calif.
83730	Smith, Herman H Inc	Brooklyn, N.Y.
83892	Tech Labs	Palisade's Park, N.J.
83905	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co Div of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp. Electronic Tube Div	Plainfield, N.J
83740	Union Carbide Corp Consumer Prod Div	New York, N.Y.
83777	Model Eng and Mfg., Inc.	Huntington, Ind.
83871	Loyd Scruggs Co	Festus, Mo.
83942	Aeronautical Inst & Radio Co.	Lodi, N.J.
84396	Arco Electronics Inc.	Great Neck, N.Y.
84396	A.J. Glesener Co., Inc	San Francisco, Calif.
84411	TRW Capacitor Div	Ogallala, Neb.
84970	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N.J.
85471	A.B Boyd Co	San Francisco, Calif
85474	R M Bracamonte & Co.	San Francisco, Calif.
85666	Koiled Kords, Inc	Hamden, Conn
85911	Seamless Rubber Co.	Chicago, Ill.
86174	Fafnir Bearing Co.	Los Angeles, Calif.
86199	Clifton Precision Products Co., Inc	Clifton Heights, Pa.
86579	Precision Rubber Products Corp	Dayton, Ohio
86684	Radio Corp of America, Electronic Comp & Devices Div	Harrison, N.J.
86928	Seastrom Mfg. Co.	Glendale, Calif.
87034	Marco Industries	Anaheim, Calif.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co	San Francisco, Calif.
87664	Van Waters & Rogers Inc	San Francisco, Calif.
87930	Tower Mfg Corp	Providence, R.I
88140	Cutler Hammer, Inc	Lincoln, Ill.
88220	Gould-National Batteries, Inc	St. Paul, Minn
88698	General Mills, Inc	Buffalo, N.Y.
89731	Graybar Electric Co	Oakland, Calif
89473	G.E. Distributing Corp.	Schenectady, N.Y.
89665	United Transformer Co	Chicago, Ill
90030	United Shoe Machinery Corp.	Beverly, Mass
90179	US Rubber Co., Consumer Ind & Plastics Prod Div.	Passaic, N.J.
90810	United Carr Fastener Corp	Chicago Ill
90970	Bearing Engineering Co.	San Francisco, Calif.
91146	ITT Cannon Elect, Inc., Salem Div.	Salem, Mass.
91260	Connor Spring Mfg Co.	San Francisco, Calif.
91345	Miller Dial & Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc	Columbus, Nebr
91662	Elco Corp.	Willow Grove, Pa.
91737	Gremar Mfg Co., Inc.	Wakefield, Mass
91827	K F Development Co.	Redwood City, Calif
91886	Malco Mfg. Co., Inc.	Chicago, Ill
91929	Honeywell Inc., Micro Switch Div.	Freeport, Ill.
91961	Nahm-Bros Spring Co.	Oakland, Calif
92180	Tru-Connector Corp	Peabody, Mass.
92367	Elgeet Optical Co. Inc.	Rochester, N.Y.
92607	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
92702	IMC Magnetics Corp.	Westbury Long Island, N.Y
92966	Hudson Lamp Co.	Kearney, N.J.
93332	Sylvania Electric Prod Inc. Semiconductor Div.	Woburn, Mass
93369	Robbins & Myers Inc.	Palisades Park, N.J.
93410	Stemco Controls, Div. of Essex Wire Corp.	Mansfield, Ohio
93632	Waters Mfg Co.	Culver City, Calif.
93929	G V Controls	Livingston, N.J
94137	General Cable Corp	Bayonne, N.J
94142	Phelps Dodge	Yonkers, N.Y.
94144	Raytheon Co., Comp Div., Ind Comp Operations	Quincy, Mass.
94148	Scientific Electronics Products, Inc	Loveland, Colo
94154	Wagner Elect. Corp., Tung-Sol Div.	Newark, N.J
94197	Curtiss-Wright Corp. Electronics Div	East Paterson, N.J
94222	South Chester Corp	Chester, Pa
94330	Wire Cloth Products, Inc.	Bellwood, Ill
94375	Automatic Metal Products Co.	Brooklyn, N.Y
94682	Worcester Pressed Aluminum Corp	Worcester, Mass
94696	Magnecraft Electric Co.	Chicago, Ill.
95023	George A Philbrick Researchers, Inc	Boston, Mass
95236	Alkes Products Corp	Dania, Fla.
95238	Continental Connector Corp	Woodside, N.Y
95263	Leecraft Mfg Co., Inc	Long Island, N.Y
95265	National Coil Co	Sheridan, Wyo
95275	Vitramon, Inc	Bridgeport, Conn
95348	Gordos Corp	Bloomfield, N.J
95354	Methode Mfg Co	Rolling Meadows, Ill
95566	Arnold Engineering Co.	Marengo, Ill.
95712	Dage Electric Co., Inc	Franklin, Ind
95984	Siemon Mfg Co	Wayne, Ill
95987	Weckesser Co	Chicago, Ill
96067	Microwave Assoc., West Inc.	Sunnyvale, Calif.
96095	Hi-Q Div. of Aerovox Corp.	Olean, N.Y
96256	Thordarson-Meissner Inc	Mt. Carmel, Ill.
96296	Solar Manufacturing Co.	Los Angeles, Calif
96306	Microswitch, Div. of Minn.-Honeywell	Freeport, Ill.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc	Burlington, Mass
96501	Excel Transformer Co	Oakland, Calif
96595	Xcelite Inc	Orchard Park, N.Y
96733	San Fernando Elect. Mfg. Co.	San Fernando, Calif
96881	Thomson Ind. Inc	Long Is., N.Y
97464	Industrial Retaining Ring Co	Irvington, N.J
97539	Automatic & Precision Mfg	Englewood, N.J
97979	Reon Resistor Corp	Yonkers, N.Y
97983	Litton System Inc., Adler Westrex Commun Div	New Rochelle, N.Y
98141	R-Tronics, Inc	Jamaica N.Y
98159	Rubber Teck, Inc	Gardena, Calif
98220	Hewlett-Packard Co., Moseley Div	Pasadena, Calif
98278	Microdot, Inc.	So. Pasadena, Calif
98291	Sealectro Corp.	Mamaroneck N.Y
98376	Zero Mfg. Co.	Burbank, Calif.
98410	Etc Inc	Cleveland, Ohio
98731	General Mills Inc., Electronics Div	Minneapolis, Minn
98734	Paeco Div of Hewlett-Packard Co	Palo Alto, Calif
98821	North Hills Electronics, Inc	Glen Cove, N.Y
98978	International Electronic Research Corp	Burbank, Calif
99109	Columbia Technical Corp	New York, N.Y
99313	Varian Associates	Palo Alto, Calif.
99378	Atlee Corp	Winchester, Mass
99515	Marshall Ind., Capacitor Div.	Monrovia, Calif
99707	Control Switch Division, Controls Co of America	El Segundo, Calif
99800	Delevan Electronics Corp	East Aurora N.Y
99848	Wilco Corporation	Indianapolis, Ind
99928	Branson Corp	Whippany, N.J.
99934	Renbrandt, Inc	Boston Mass
99942	Hoffman Electronics Corp Semiconductor Div.	El Monte, Calif
99957	Technology Instrument Corp. of Calif	Newbury Park, Calif

THE FOLLOWING HP VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK

0000F	Malco Tool and Die	Los Angeles, Calif.
0000Z	Willow Leather Products Corp.	Newark, N.J
000AB	ETA	England
000BB	Precision Instrument Components Co	Van Nuys, Calif
000CS	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado
000MM	Rubber Eng & Development	Hayward, Calif
000NN	A "N" D Mfg Co	San Jose, Calif
000QQ	Cooltron	Oakland, Calif
000WW	California Eastern Lab	Burlington, Calif
000YY	S K Smith Co	Los Angeles Calif

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From FSC. Handbook Supplements

SECTION VII
MANUAL CHANGES AND OPTIONS

7-1. MANUAL CHANGES

7-2. CURRENT INSTRUMENTS.

7-3. This manual applies directly to standard Model 5285A Universal Input Plug-in having the following serial prefix number (refer to Paragraph 1-14): 602-, or 612-.

7-4. OLDER INSTRUMENTS.

7-5. This manual covers all instruments currently available. As instrument changes are made and this manual is revised, backdating information to cover older instruments will be included in this section.

7-6. NEWER INSTRUMENTS.

7-7. As changes are made in the Model 5285A, newer instruments may have serial prefix numbers not listed in this manual. The manuals for these instruments will be supplied with an additional "Manual Changes" sheet containing the required information; contact your nearest Hewlett-Packard sales and service office for information if this sheet is missing.

7-8. OPTIONS.

7-9. There are currently no options offered for the Model 5285A; however, modified versions are available on special order. Manuals for instruments having electrical modifications include an insert describing the modification, in addition to any possible "Manual Changes" sheet (Paragraph 7-7). Contact the nearest Hewlett-Packard sales and service office if either of these sheets is missing from the manual for a special instrument. Be sure to refer to the instrument by its full specification number and name (example: H17-5285A, Universal Input Plug-In.

Note

The 5285A Universal Input Plug-In Units with serial prefix number 602 and serial numbers 612-00101 through 612-00140 have an error in the assembly identification silkscreening. A3 should be A4 and A4 should be A3. A5 should be A6 and A6 should be A5.

SECTION VIII
CIRCUIT DIAGRAMS

8-1. INTRODUCTION.

8-2. This section includes the following:

a. General Notes for Schematic Diagrams (Figure 8-1).

b. Block Diagram (Figure 8-2).

c. Schematic Diagrams and Component Location illustrations of Model 5285A circuits and assemblies, in the order of their assembly designation (A1 through A9, Figures 8-3 through 8-8). These figures may also include waveforms and voltages.

8-3. The Block Diagram or any schematic diagram, when unfolded, can be used with any other part of this manual, or with the manual closed.

8-4. The waveforms in Figure 4-4, Page 4-5, are also referenced to the Bottom Internal view, Figure 5-2, page 5-9, and the Component Locators and Schematic Diagrams Figures 8-7 and 8-8, pages 8-13 and 8-15.

SYMBOLS

FRONT PANEL

REAR PANEL

KNOB CONTROL

SCREWDRIVER ADJUST

MAIN SIGNAL PATH

FEEDBACK PATH

CONDUCTING ELEMENT

CW — WIPER MOVES TOWARD "CW" WHEN CONTROL IS ROTATED CLOCKWISE

POWER LINE GROUND

CIRCUIT COMMON GROUND

8 — TEST POINT

"AND" GATE

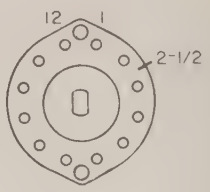
INHIBIT GATE

"OR" GATE

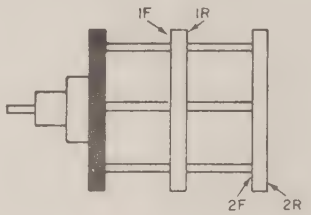
WAVEFORMS SHOWN ARE TYPICAL

SWITCH DESIGNATIONS

A3S1BR(2-1/2)



A3S1	SWITCH S1 WITHIN ASSEMBLY A3
B	2ND WAFER FROM FRONT (A=1ST, ETC)
R	REAR OF WAFER (F=FRONT)
(2-1/2)	TERMINAL LOCATION ($2\frac{1}{2}$) (VIEWED FROM FRONT)



REFERENCE DESIGNATIONS

REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.

ASSEMBLY	ABBREVIATION	COMPLETE DESCRIPTION
A25	C1	A25C1
A25A1	CR1	A25A1CR1
NO PREFIX	J3	J3

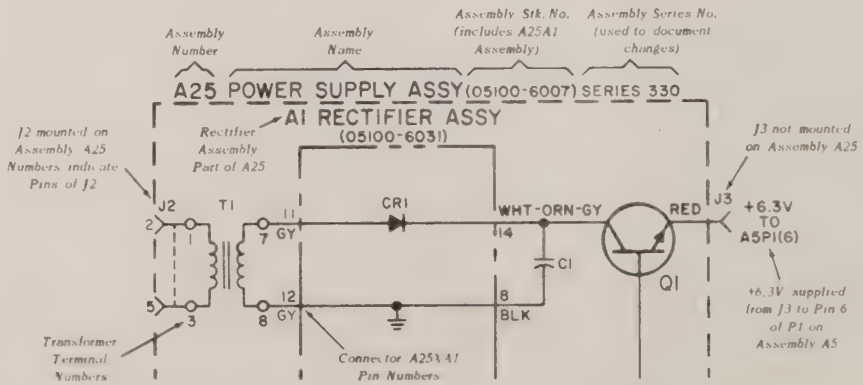
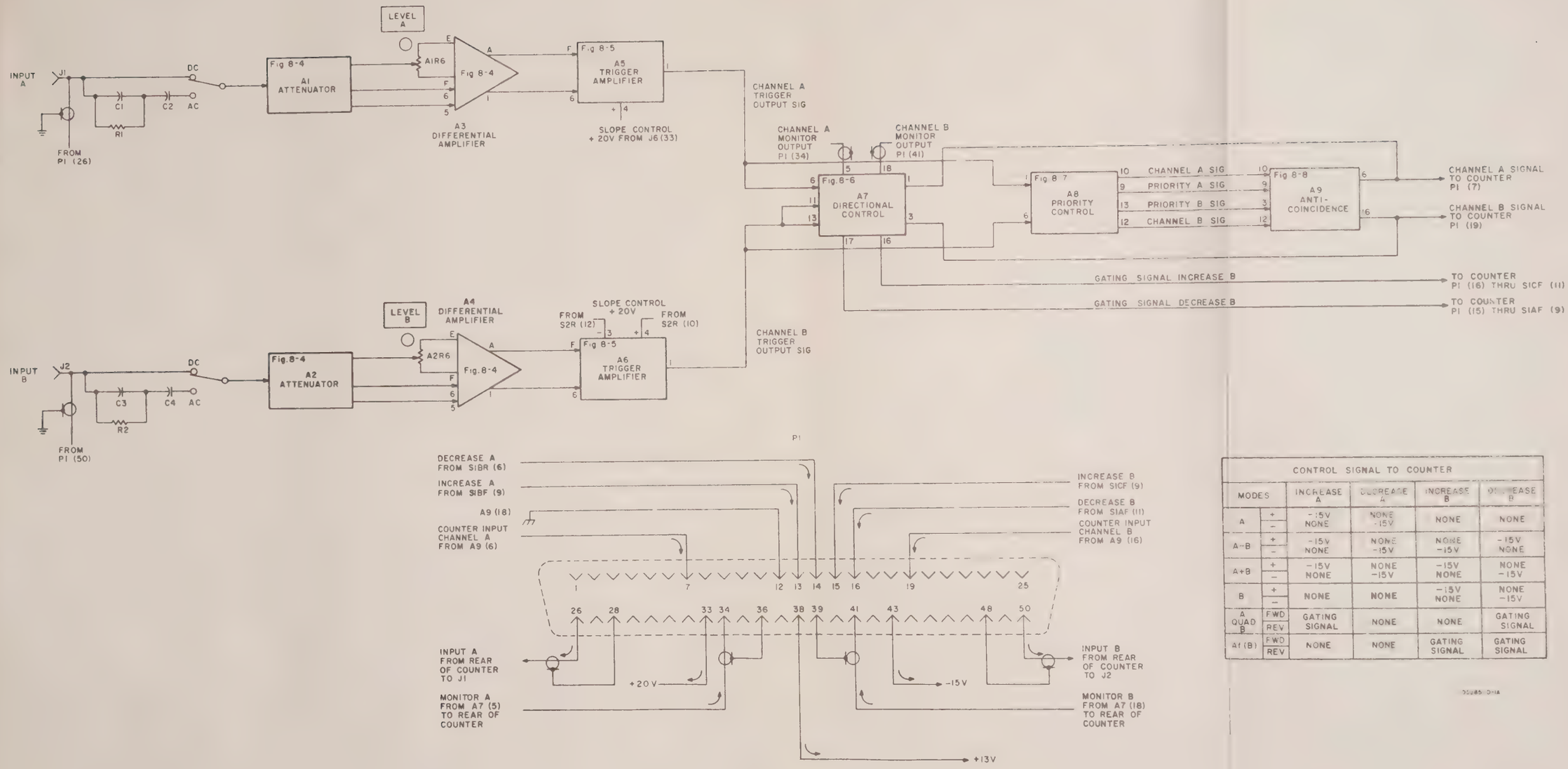


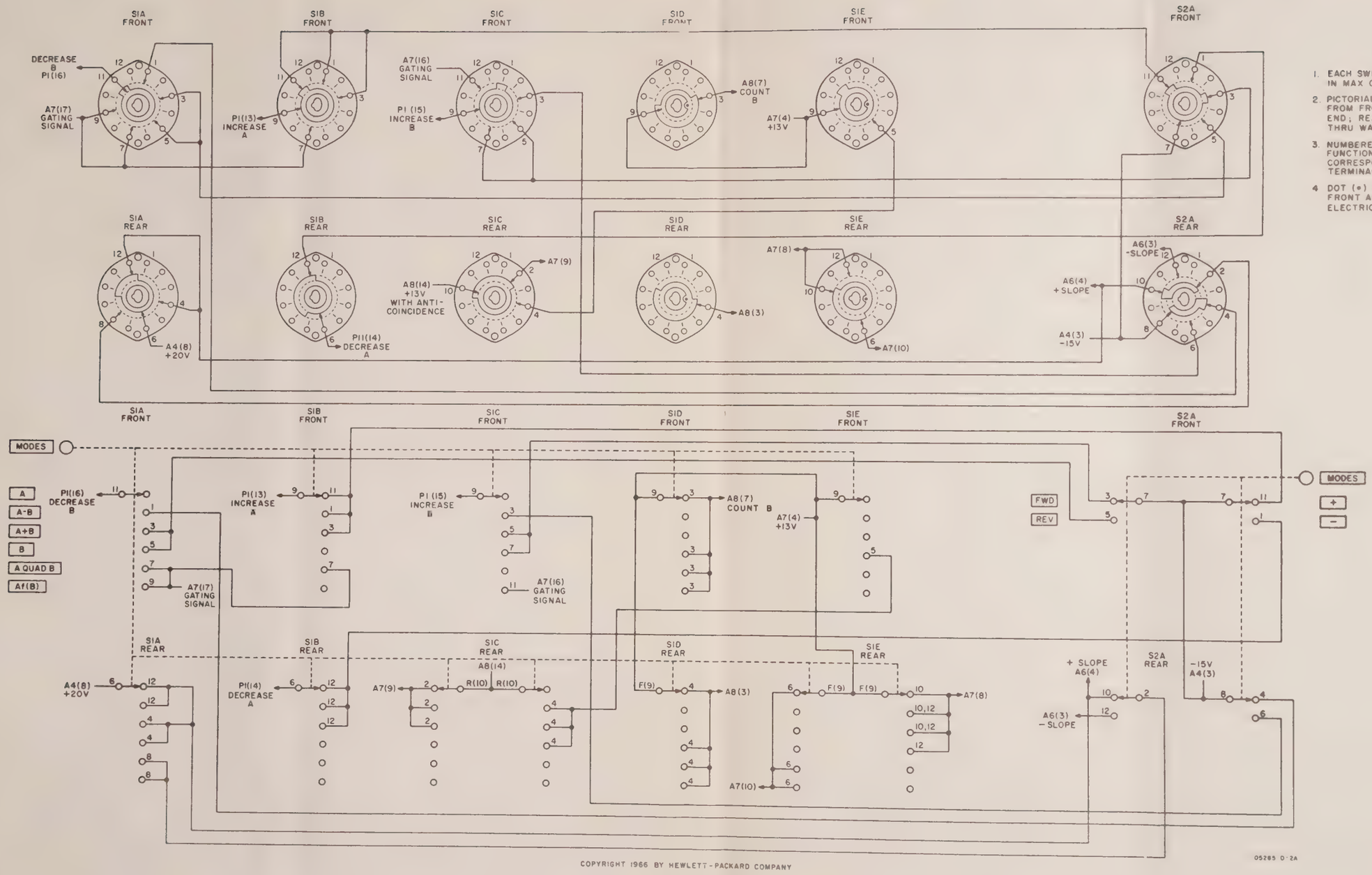
Figure 8-1. Schematic Diagram Notes



CONTROL SIGNAL TO COUNTER					
MODES		INCREASE A	DECREASE A	INCREASE B	DECREASE B
A	+	-15V	NONE	NONE	NONE
	-	NONE	-15V		
A-B	+	-15V	NONE	NONE	-15V
	-	NONE	-15V	-15V	NONE
A+B	+	-15V	NONE	-15V	NONE
	-	NONE	-15V	NONE	-15V
B	+	NONE	NONE	-15V	NONE
	-			NONE	-15V
A QUAD B	FWD	GATING SIGNAL	NONE	NONE	GATING SIGNAL
	REV				
Af (B)	FWD	NONE	NONE	GATING SIGNAL	GATING SIGNAL
	REV				

D0285-DHA

Figure 8-2. Block Diagram and P1



NOTES

1. EACH SWITCH SECTION SHOWN IN MAX CCW POSITION.
2. PICTORIAL DIAGRAM AS SEEN FROM FRONT OF SWITCH (KNOB END; REAR SECTION PROJECTED THRU WAFER.
3. NUMBERED TERMINALS IN FUNCTIONAL SWITCH DIAGRAM CORRESPOND WITH NUMBERED TERMINALS IN PICTORIAL DIAGRAM
4. DOT (•) ON ROTER INDICATES FRONT AND REAR ROTERS ARE ELECTRICALLY CONNECTED

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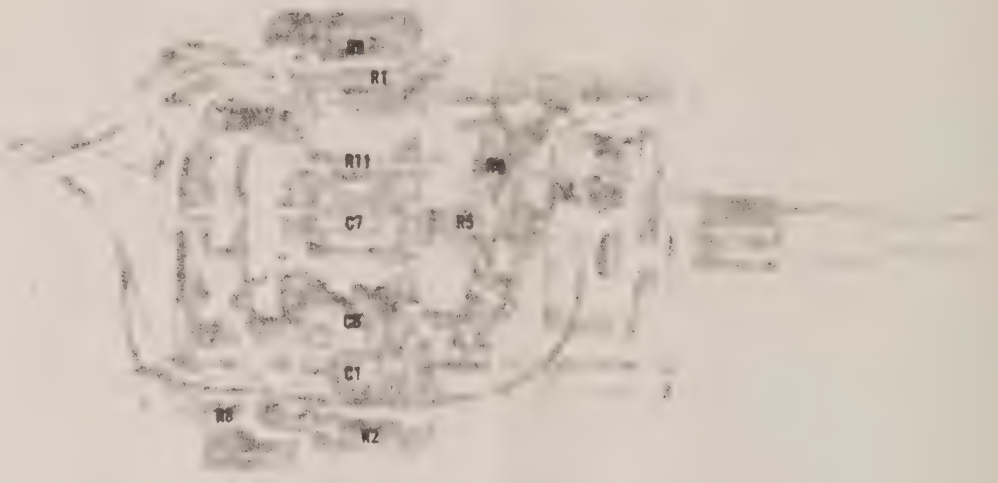
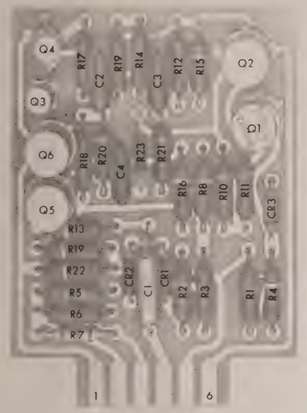
Figure 8-3. Mode Switches S1 and S2

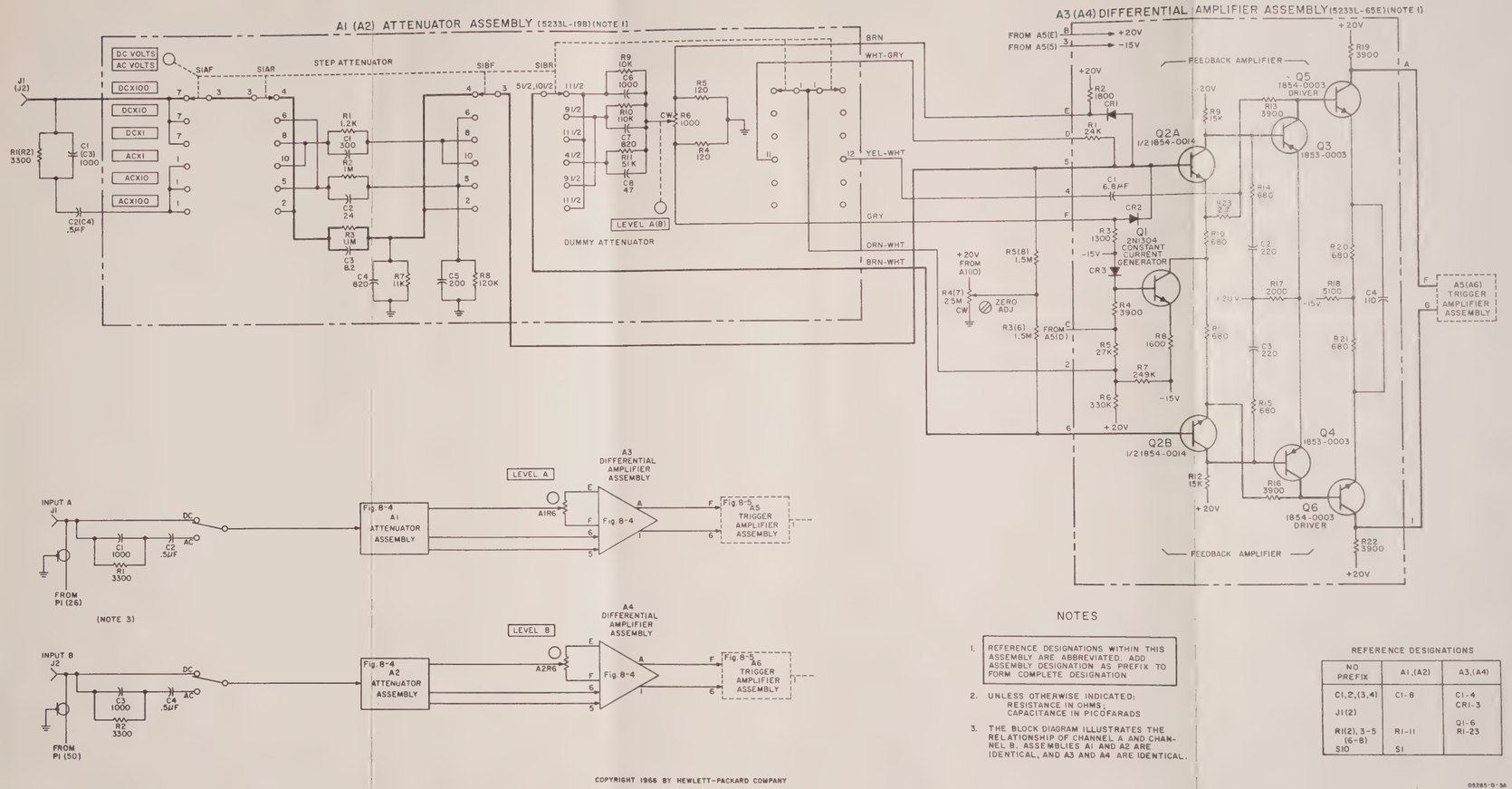


TOP

BOTTOM



02332-2



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NOTES

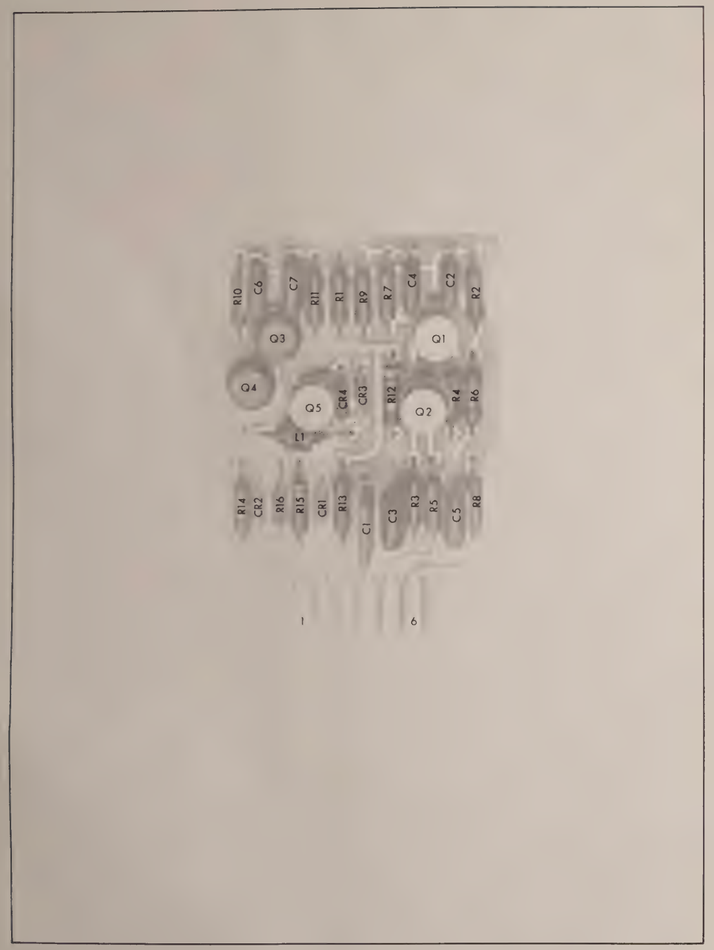
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY DESIGNATION AS PREFIX TO FORM COMPLETE DESIGNATION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS
3. THE BLOCK DIAGRAM ILLUSTRATES THE RELATIONSHIP OF CHANNEL A AND CHANNEL B. ASSEMBLIES A1 AND A2 ARE IDENTICAL, AND A3 AND A4 ARE IDENTICAL.

REFERENCE DESIGNATIONS

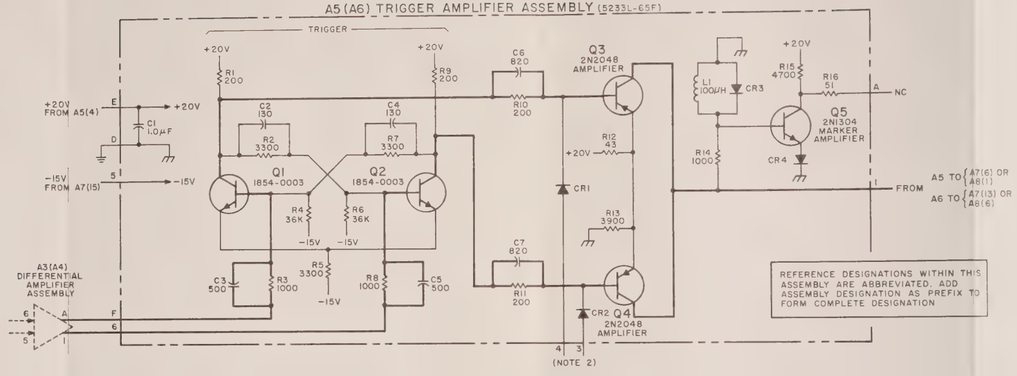
NO PREFIX	A1,(A2)	A3,(A4)
C1,2,(3,4)	C1-8	C1-4 CR1-3
J1(2)		Q1-6 R1-23
R1(2),3-5 (6-8)	R1-11	
S10	S1	

05285-0-3A

Figure 8-4. Attenuator Assembly A1(A2) and Differential Amplifier Assembly A3(A4)



02332-1
05233-A 14



NOTES

1. UNLESS OTHERWISE INDICATED
   RESISTANCE IN OHMS
   CAPACITANCE IN PICOFARADS
2. FOR A5 +20V IS CONNECTED TO PIN 4 FROM P1(33) FOR POSITIVE SLOPE. FOR A6 SLOPE IS SELECTED BY MODE SW S2; PIN 3 CONNECTED TO S2(R-12), PIN 4 CONNECTED TO S2(R-10)

REFERENCE DESIGNATIONS
A5(A6)
C1-6 CR1-4 Q1-5 R1-16

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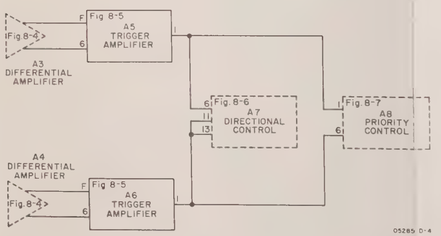


Figure 8-5. Trigger Amplifier Assembly A5(A6)

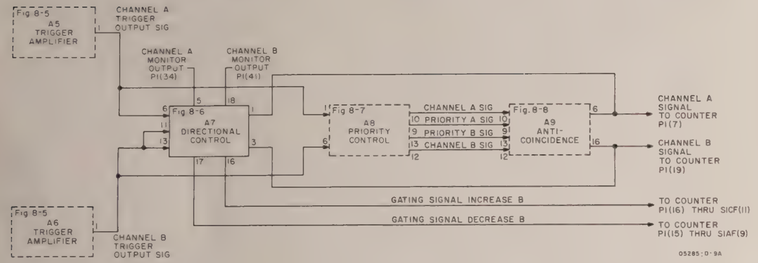
NOTES

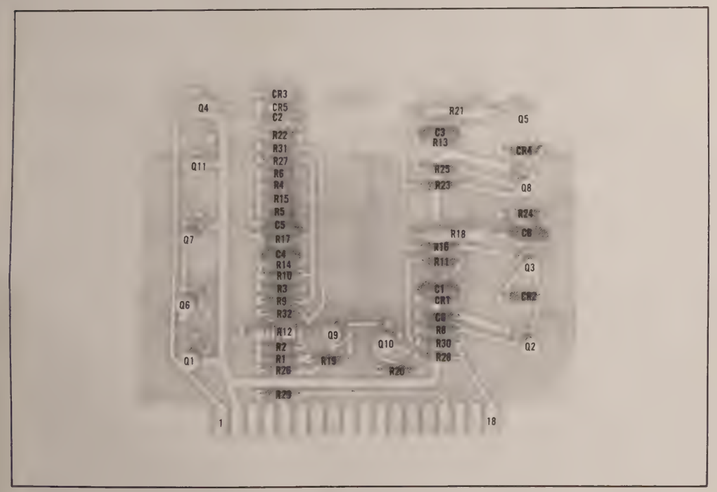
1 UNLESS OTHERWISE INDICATED:
RESISTANCE IN OHMS
CAPACITANCE IN PICOFARADS

2 WITH ANTICOINCIDENCE ASSY
NO CONNECTION BETWEEN 1 AND 2
OR 3 AND 4 WITHOUT ANTI-
COINCIDENCE ASSY, 1 AND 2
AND 3 AND 4 ARE CONNECTED

REFERENCE DESIGNATIONS

NO PREFIX	A7
S1	C1 CR1-5 Q1-11 R1-32





02332-2

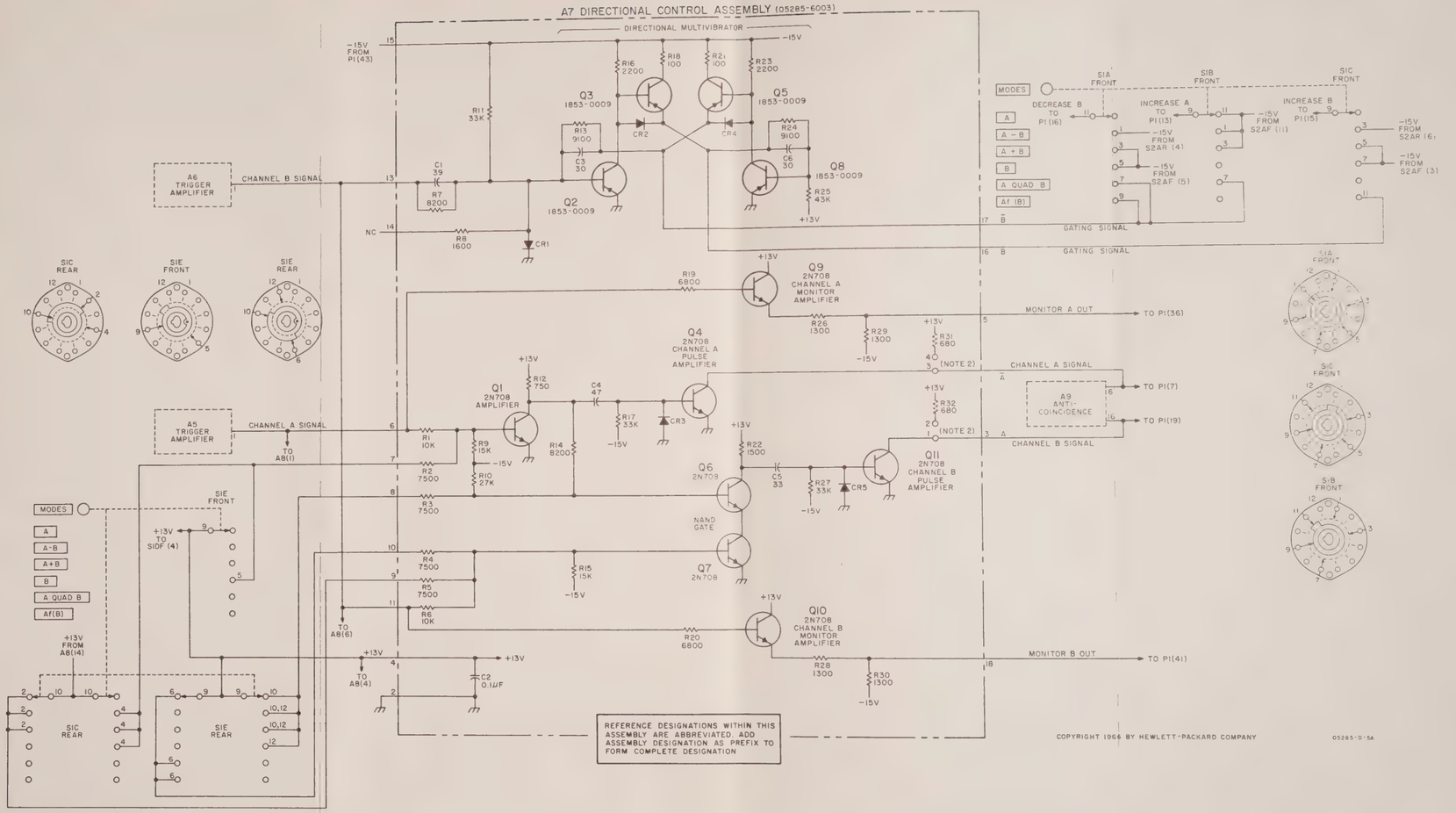
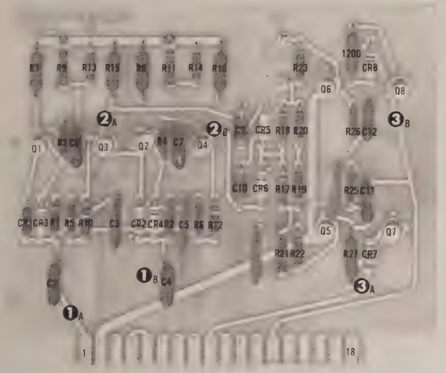
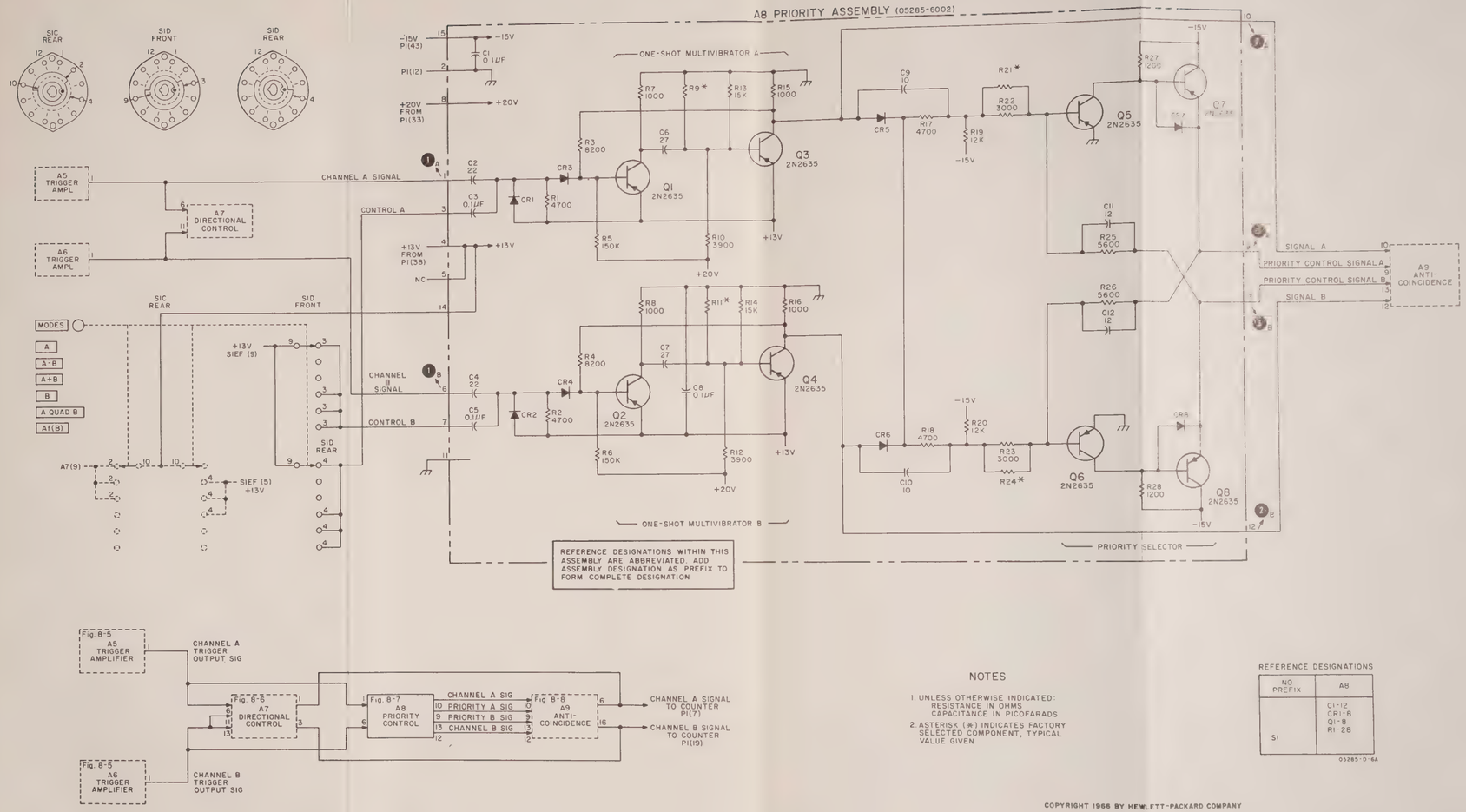


Figure 8-6. Directional Control Assembly A7



02332-2



NOTES

1. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS CAPACITANCE IN PICOFARADS
2. ASTERISK (*) INDICATES FACTORY SELECTED COMPONENT, TYPICAL VALUE GIVEN

REFERENCE DESIGNATIONS

NO PREFIX	A8
S1	C1-12 CR1-8 Q1-8 R1-28

05285-D-6A

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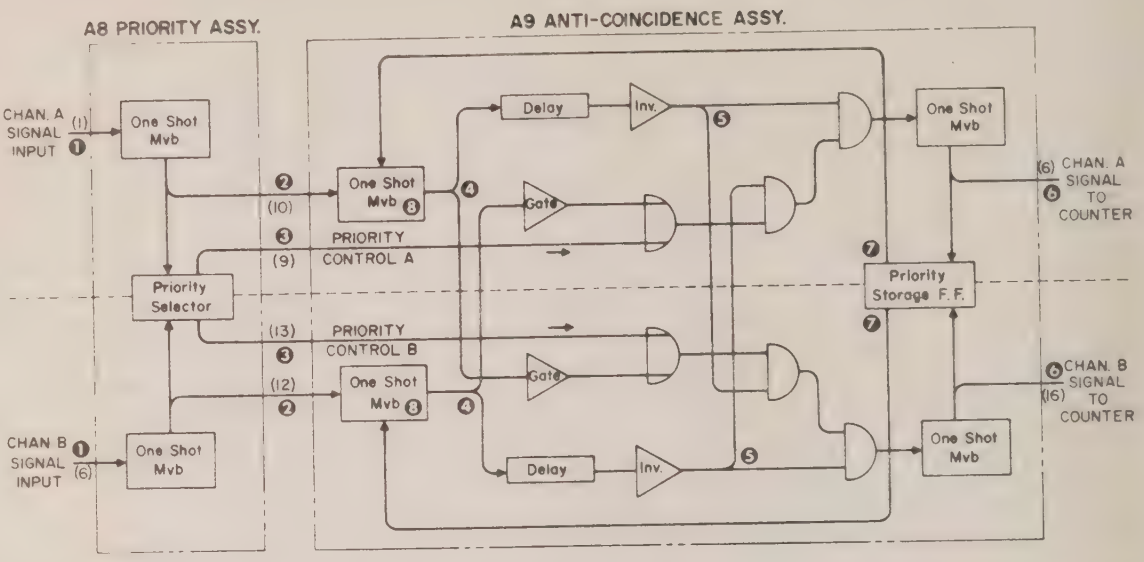
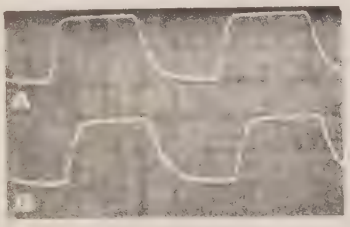
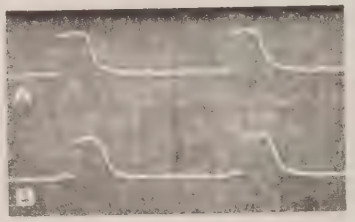
Figure 8-7. Priority Assembly A8

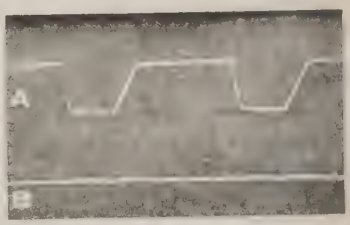




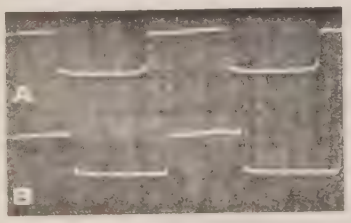
❶ A and B inputs to A8



❷ A and B inputs to A9

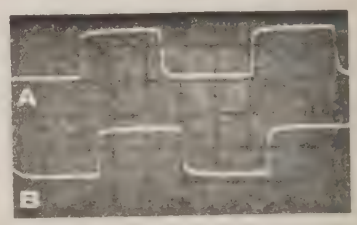


❸ Priority control signals

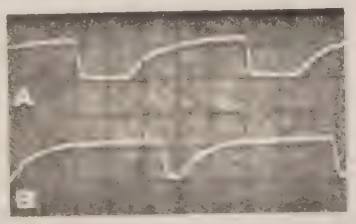


❹ One shot multivibrator outputs

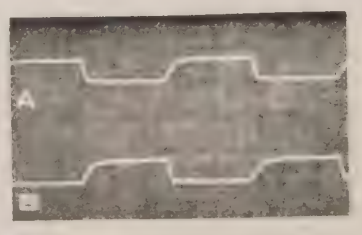
HP 175A Oscilloscope
HP 1750B Vertical Amplifier
Vertical Sensitivity = 10V/cm
Horizontal Sweep = 200 ns/cm
External Sync to
Trigger Output A5(1)



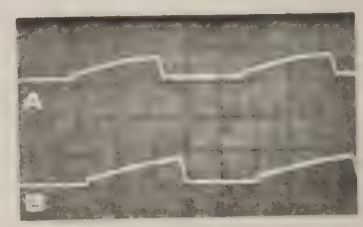
❺ Inverting amplifier outputs



❻ A and B signals to counter



❼ Priority storage flip-flop outputs



❽ Control signals

Logic Diagrams and Waveforms, A8, A9

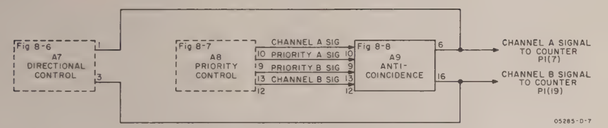
NOTES

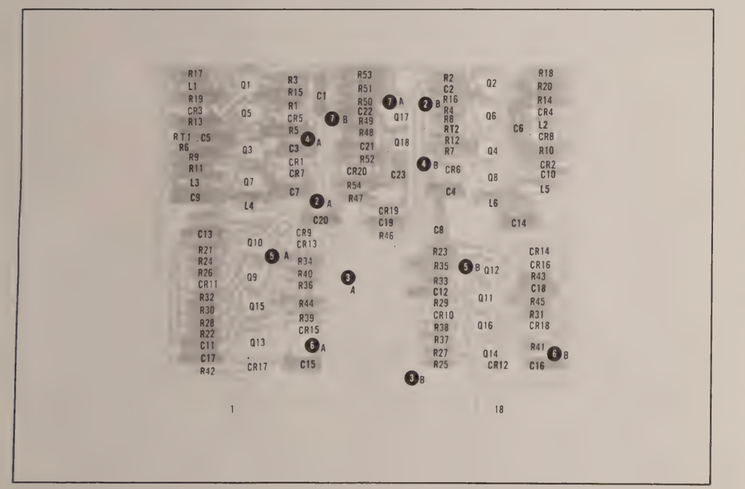
1. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS
   CAPACITANCE IN PICOFARADS
   INDUCTANCE IN MICROHENRIES

2. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUE SHOWN

REFERENCE DESIGNATIONS

A9
C1-23
CR1-20
L1-6
Q1-18
R1-54
RT1,2





02332-2
05285 A-5

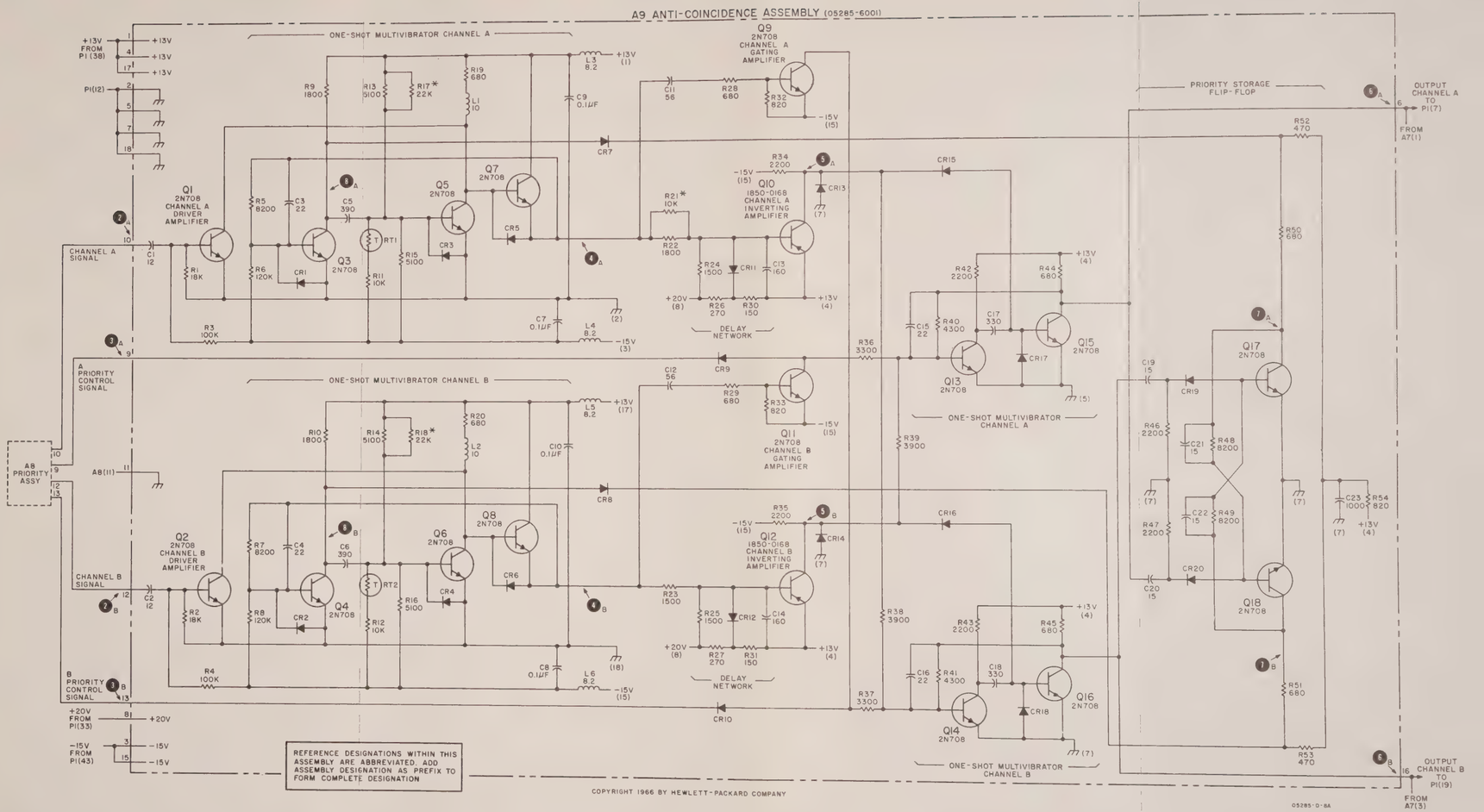


Figure 8-8. Anticoincidence Assembly A9

ELECTRONIC

SALES & SERVICE OFFICES

UNITED STATES

ALABAMA
P.O. Box 4207
2003 Byrd Spring Road S.W.
Huntsville 35802
Tel: (205) 881-4591
TWX: 810-726-2204

ARIZONA
2336 E. Magnolia St.
Phoenix 85034
Tel: (602) 252-5061
TWX: 910-951-1330

5737 East Broadway
Tucson 85716
Tel: (602) 298-2313
TWX: 910-952-1162

CALIFORNIA
1430 East Orangethorpe Ave.
Fullerton 92631
Tel: (714) 870-1000

3939 Lankershim Boulevard
North Hollywood 91604
Tel: (213) 877-1282
TWX: 910-499-2170

1101 Embarcadero Road
Palo Alto 94303
Tel: (415) 327-6500
TWX: 910-373-1280

2220 Watt Ave.
Sacramento 95825
Tel: (916) 482-1463
TWX: 910-367-2092

9606 Aero Drive
San Diego 92123
Tel: (714) 279-3200
TWX: 910-335-2000

COLORADO
7965 East Prentice
Englewood 80110
Tel: (303) 771-3455
TWX: 910-935-0705

CONNECTICUT
12 Lunar Drive
New Haven 06525
Tel: (203) 389-6551
TWX: 710-465-2029

FLORIDA
P.O. Box 24210
2806 W. Oakland Park Blvd.
Ft. Lauderdale 33307
Tel: (305) 731-2020
TWX: 510-955-4099

P.O. Box 13910
6177 Lake Ellenor Dr.
Orlando, 32809
Tel: (305) 859-2900
TWX: 810-850-0113

GEORGIA
P.O. Box 28234
450 Interstate North
Atlanta 30328
Tel: (404) 436-6181
TWX: 810-766-4890

HAWAII
2875 So. King Street
Honolulu 96814
Tel: (808) 955-4455

ILLINOIS
5500 Howard Street
Skokie 60076
Tel: (312) 677-0400
TWX: 910-223-3613

INDIANA
3839 Meadows Drive
Indianapolis 46205
Tel: (317) 546-4891
TWX: 810-341-3263

LOUISIANA
P.O. Box 856
1942 Williams Boulevard
Kenner 70062
Tel: (504) 721-6201
TWX: 810-955-5524

MARYLAND
6707 Whitestone Road
Baltimore 21207
Tel: (301) 944-5400
TWX: 710-862-9157

P.O. Box 1648
2 Choke Cherry Road
Rockville 20850
Tel: (301) 948-6370
TWX: 710-828-9684

MASSACHUSETTS
32 Hartwell Ave.
Lexington 02173
Tel: (617) 861-8960
TWX: 710-326-6904

MICHIGAN
21840 West Nine Mile Road
Southfield 48075
Tel: (313) 353-9100
TWX: 810-224-4882

MINNESOTA
2459 University Avenue
St. Paul 55114
Tel: (612) 645-9461
TWX: 910-563-3734

MISSOURI
11131 Colorado Ave.
Kansas City 64137
Tel: (816) 763-8000
TWX: 910-771-2087

148 Weldon Parkway
Maryland Heights 63043
Tel: (314) 567-1455
TWX: 910-764-0830

NEW JERSEY
W. 120 Century Road
Paramus 07652
Tel: (201) 265-5000
TWX: 710-990-4951

1060 N. Kings Highway
Cherry Hill 08034
Tel: (609) 667-4000
TWX: 710-892-4945

NEW MEXICO
P.O. Box 8366
Station C
6501 Lomas Boulevard N.E.
Albuquerque 87108
Tel: (505) 265-3713
TWX: 910-989-1665

156 Wyatt Drive
Las Cruces 88001
Tel: (505) 526-2485
TWX: 910-983-0550

NEW YORK
6 Automation Lane
Computer Park
Albany 12205
Tel: (518) 458-1550
TWX: 710-441-8270

1219 Campville Road
Endicott 13760
Tel: (607) 754-0050
TWX: 510-252-0890

82 Washington Street
Poughkeepsie 12601
Tel:'(914) 454-7330
TWX: 510-248-0012

39 Saginaw Drive
Rochester 14623
Tel: (716) 473-9500
TWX: 510-253-5981

5858 East Molloy Road
Syracuse 13211
Tel: (315) 454-2486
TWX: 710-541-0482

1 Crossways Park West
Woodbury 11797
Tel: (516) 921-0300
TWX: 510-223-0811

NORTH CAROLINA
P.O. Box 5188
1923 North Main Street
High Point 27262
Tel: (919) 885-8101
TWX: 510-926-1516

OHIO
25575 Center Ridge Road
Cleveland 44145
Tel: (216) 835-0300
TWX: 810-427-9129

3460 South Dixie Drive
Dayton 45439
Tel: (513) 298-0351
TWX: 810-459-1925

1120 Morse Road
Columbus 43229
Tel: (614) 846-1300

OKLAHOMA
6301 N. Meridian Avenue
Oklahoma City 73122
Tel: (405) 721-0200
TWX: 910-830-6862

OREGON
Westhills Mall, Suite 158
4475 S.W. Scholls Ferry Road
Portland 97225
Tel: (503) 292-9171
TWX: 910-464-6103

PENNSYLVANIA
2500 Moss Side Boulevard
Monroeville 15146
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Telex: SATRON 3450 332

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Hewlett-Packard Ges.m.b.H
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Hewlett-Packard Benelux
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Datavej 38
DK-3460 **Birkerod**
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Telex: 16640 hp as

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Bulevardi 26
P.O. Box 12185
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Telex: 51957

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Athens 126
Tel: 3230-303
Cable: RAKAR Athens
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IRELAND
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Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
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Telex: 32046 via Milan

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S.A./N.V.
Avenue du Col-Vert, 1
B-1170 **Brussels**
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Cable: PALOBEN Brussels
Telex: 23 494

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Weerdestein 117
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Tel: 020-42 77 77
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Telex: 13 216 hepa nl

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Nesveien 13
N-1344 **Haslum**
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Telex: 16621 hpnas n

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P.O. Box 2531
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Telex: 1598

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Jerez No 8
Madrid 16
Tel: 458 26 00
Telex: 23515 hpe

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Tel: (3) 203 62 00
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TURKEY
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Saglik Sok No. 15/1
Ayaspasa-Beyoglu
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Istanbul
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UNITED KINGDOM
Hewlett-Packard Ltd.
224 Bath Road
Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
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Stamford New Road
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SOCIALIST COUNTRIES PLEASE CONTACT:
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P.O. Box 7
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Yokogawa-Hewlett-Packard Ltd.
Nisei Ibaragi Bldg.
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Tel: (0726) 23-1641
Telex: 5332-385 YHP OSAKA

Yokogawa-Hewlett-Packard Ltd.
Ito Building
No. 59, Kotori-cho
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Lourenco Marques
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Singapore, 3
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Hewlett-Packard Far East Area Office
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Singapore 3
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Cable: HEWPACK SINGAPORE

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Milnerton
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Johannesburg
Tel: 725-2080, 725-2030
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Cape Town
Tel: 3-6019, 3-6545
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Telex: 5-0006

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P.O. Box 99
Overport, Natal
Tel: 88-6102
Telex: 567954
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39 Chung Shiao West Road
Sec. 1
Overseas Insurance
Corp. Bldg. 7th Floor
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Via Marocco, 7
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Cable: HEWPACKIT Rome
Telex: 61514

OTHER AREAS NOT LISTED, CONTACT:
Hewlett-Packard
INTERCONTINENTAL
3200 Hillview Ave.
Palo Alto, California 94304
Tel: (415) 326-7000
(Feb. 71 493-1501)
TWX: 910-373-1267
Cable: HEWPACK Palo Alto
Telex: 034-8300, 034-8493

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